The Foundry

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...got to be

it's being done with

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IF YOU sharpen your pencil for rigid specification jobs you've got to know your stuff.

Your core oil must come through 100% and never give you an unexpected load of defectives.

It must give you rock-bottom costs for figuring and then it must deliver the goods at that figure.

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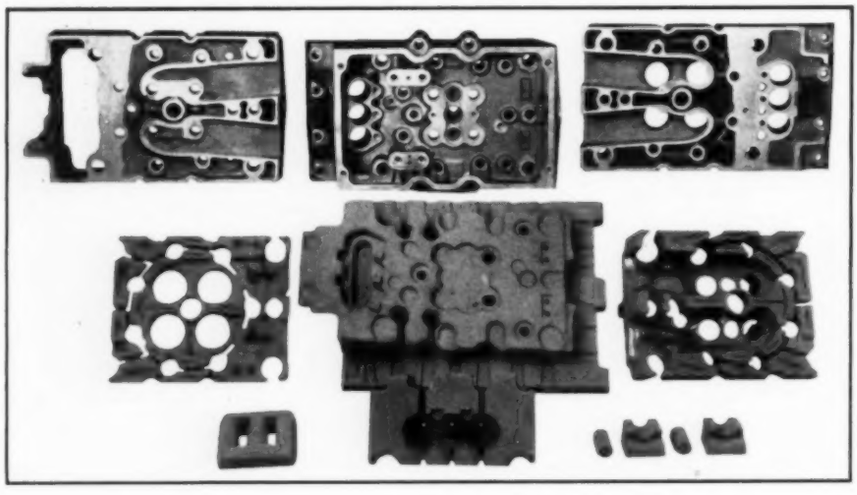


PICTURES

In each picture is shown a complete casting and the same casting cut through to show the sections.

Below the castings are shown the principal cores, chunk cores being omitted from photographs.

All cores on these Diesel engine jobs are made with Linoil.

THE WERNER G.

(DIVISION OF ARCHER -

The Foundry Editorial

Survey Shows Silicosis Hazard Mild in Foundries

RESULTS of a survey made recently by the division of hygiene, New York state department of labor, on the extent of silicosis in the foundry industry, indicate the fallacy of much misleading information circulated during the past few years concerning health conditions in foundries. For the first time since silicosis became a live issue, the foundry industry now has authentic data collected from a sufficient diversity of plants to give an intelligent understanding of the existing situation. The extensive survey was conducted under the supervision of Dr. Leonard Greenburg, executive director of the division, Dr. William Siegal, director of the division of tuberculosis, and Dr. Adelaide Ross Smith, division of industrial hygiene.

Exceptional care was exercised in organizing the survey to obtain a true cross section of the foundry industry in the Empire State. A thorough study first was made of all foundries in the state to determine distribution by size, location, number of employes and metals cast. The survey was conducted in 80 foundries out of a total of 311 in the state and included 4066 workers, or approximately one third of the 11,470 foundry workers employed in the state. Of the 80 plants, 40 produced gray iron castings, 3 steel, 17 nonferrous and 20 a combination of several classes of castings.

As a result of 4066 x-ray studies on foundry workers, silicosis in all stages was found in only 2.7 per cent. Of the 2.7 per cent silicosis cases, 2.2 per cent were in the first stage, 0.4 per cent in the second stage and 0.1 per cent in the third stage. According to Dr. Greenburg, the over-all rate of silicosis in the foundry industry, approximately 2.7 per cent, does not represent a serious hazard, but one which readily can be surmounted by a simple, straightforward attack on dust control in the foundry industry.

This statement of Dr. Greenburg, based on the results of a thorough survey and backed by his extensive experience, should serve as an incentive to the foundry industry to provide a complete solution of the problem. According to a recent bulletin of the New York State department of labor, "A satisfactory and comprehensive program for the prevention of silicosis in the majority of dusty industries will include physical supervision and education, alternation of men at dusty and nondusty work, segregation of dusty processes, local exhaust ventilation, or masks or helmets, or both and finally plant cleanliness and an invincible determination on the part of those responsible to keep down dust. The efficiency of measures to remove or control dust can be demonstrated quite simply by dust counts and these should always be made at intervals in conjunction with a preventative program."

Hold the Good Workmen

WHILE foundries in general are operating at a low rate, some improvement in the general business situation and a slightly better movement of pig iron to foundries point to the possibility that recovery has started. Manpower undoubtedly will be the first major problem as operations show substantial improvement. The greatest need will be for skilled workmen and capable executives.

In too many instances not enough attention is being paid to holding the capable men in the individual organizations. Personnel is the most important factor in the success of any business, and unless foundries maintain their organizations through the present low period, a shortage of skilled men, far exceeding that experienced in the early months of 1937 will result. In other words, don't let your good men get away.

Carry Display to Customer

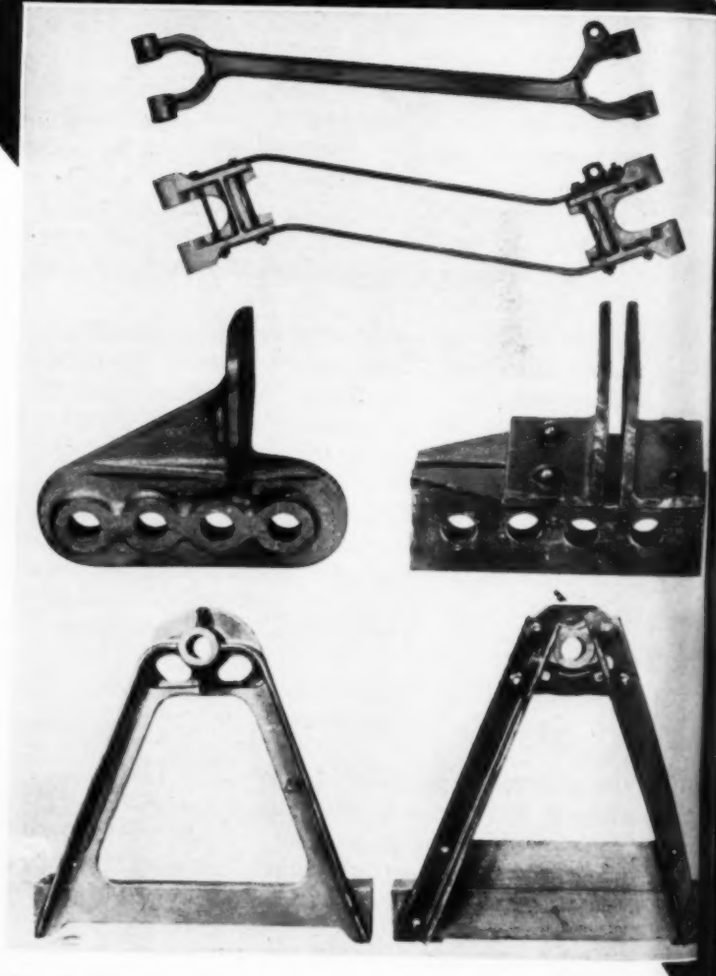
AT TIMES the foundry industry moves ahead rapidly. Already the idea of a display of castings in the front office of the foundry, as discussed in the June issue, appears antiquated. Instead of bringing the customer to the display, the Lake City Malleable Co., Cleveland, is carrying the story of production, properties and uses of malleable castings to the customer through the use of a trailer, as described on page 72.

Congratulations to President J. H. Redhead and the Lake City company. Benefits from this advertising-educational program will extend to the entire malleable industry.

Frank G. Steinebach
Editor

Design for Malleable

By
JAMES H. LANSING
Shop Practice Engineer
Malleable Founders' Society
Cleveland



WHILE the competitive pressure of modern business forces each producer to acquire a thorough understanding of his customer's practices or of the ultimate consumer's needs, it is hardly less important to develop equal knowledge of the supplier's operations. The former is required for intelligent sales promotion while the latter is a requisite for efficient use of source materials.

As this thought relates to users of foundry products, a practical lesson in castings production serves to develop a better understanding of part design. This is because the product of custom or jobbing castings is, to a large degree, a joint undertaking of the buyer and seller; and it is generally customary for the buyer to furnish the pattern equipment or even flasks, core dryers, dies, gages, etc.

Such a lesson is contained in the recent experience of a large motor truck corporation which utilized the facilities of a malleable iron producer for a program of special training of its engineering personnel.

The period of brisk business activity during 1936 and 1937, as well as the recent advances in technical developments, found this truck manufacturer, in company with many other industrial units, lacking in highly trained talent. For example, the engineering division of one of its eastern branches was composed of 172 employes, including 90 draftsmen and a staff of detailers and layout men, of which a large proportion were new to industry or without previous production experience.

It was decided, on the occasion of reduced activity, to prepare these younger men for greater responsibilities by a concentrated training schedule. The

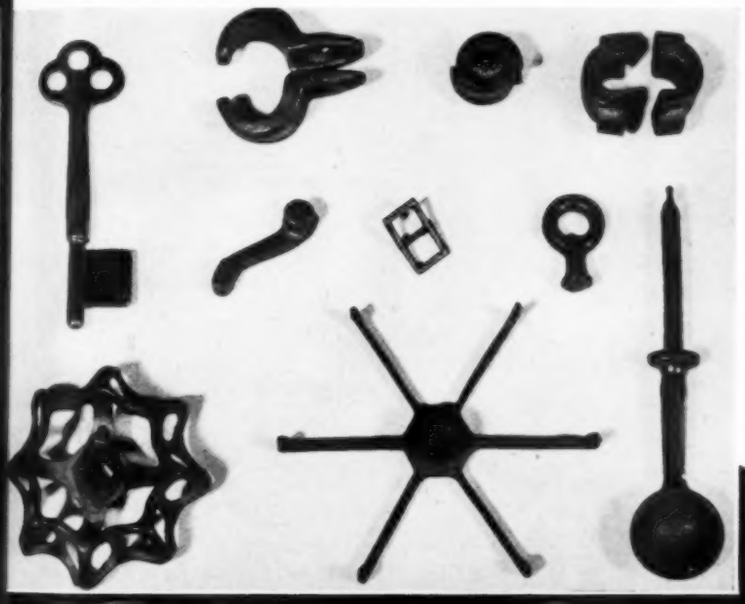
Fig. 1 (Upper left)—Wire tooth of rotary plow, two types of integrally cast roller chain links, clamp for rotary plow, and finished part of theatrical curtain track carrier. Fig. 2 (Above)—Top two specimens represent connecting rod with 1-piece part replacing an assembly. Middle row of views is different treatments of a hitch, and bottom row shows malleable bracket replacing an assembly. Fig. 3 (Upper right)—Some lightweight parts which indicate the applicability of malleable cast iron to precise design. Fig. 4 (Right)—Top row across, cut-away view of integrally cast roller chain link, theatrical curtain carrier, cope mold for chain links. Bottom row across, spider for rotary hoe, roller chain link, gate of castings of chain links, and pattern and drag mold for chain links

Castings Is Important

program included the use of a draftsmen's manual, prepared specially to acquaint the newer men with the company standards for parts, materials, and fits; and containing drawings and descriptive matter relating to company products as well as data of general value to new designers. The use of this guide manual was supplemented by lectures and production illustrations of machine shop practice, sheet metal work, press and die operations, fabrication, subassembly and final assembling operations.

A knowledge of foundry practice was deemed to have particular significance since its relation to part design has always been a source of concern to casting purchasers. Moreover, malleable foundrymen frequently advise that manufacturing and assembly costs can be reduced, as well as part performance improved, by due regard for foundry possibilities. Accordingly, an eastern malleable iron foundry was accepted as a temporary school for the practical edification of 90 engineers and draftsmen.

There was general surprise at the actual operations and at some of the new developments in the malleable industry. The *student guests* were permitted observation, and given explanations by competent foundrymen, of the various steps in casting production: Pattern making, melting, molding, core making, pouring, annealing, cleaning, straightening, testing and inspection. Importance of casting design to efficient part manufacture was emphasized, and some of the effects of (*Please turn to page* 71)



Practices Close Cupola

SEVERAL pans containing alloys are shown in Fig. 20. These alloys include nickel, chromium, copper and molybdenum. A scale for the accurate weighing of the alloys is shown in the foreground.

Fig. 24 shows the cupola control panel within easy reach of the supervisor should it be necessary to make any changes, as well as being under constant observation. This panel contains the windbox pressure record-

LABORATORY REPORT- FOUNDRY DIVISION — Nº 9208

SAMPLE OF: 1E 75	SYMBOL OR LAB INITIAL AND NUMBER: 2B 625	PART NAME: Cranks	
LOCATION ON CASTING: SAMPLE TAKEN FROM	DATE CAST: 9-15-37	LABORATORY DATES: RECEIVED	REPORTED
SOURCE OF SUPPLY			

CHEMICAL ANALYSIS	FURNACE	LABORATORY	CHECK			PHYSICAL ANALYSIS
CARBON TOTAL	3.04	3.00	3.03	MOISTURE	3.11	TRANSVERSE STRENGTH LBS
CARBON COMBINED				V.C.M.		DEFLECTION INCHES
CARBON GRAPHITE				F.C.		BRINELL
MANGANESE	.76	.77	.80	ASH	.79	TENSILE STRENGTH LBS
SULPHUR	.115	.112	.107	SULPHUR	.093	IMPACT FT. - LBS
PHOSPHORUS	.142	.135	.111	ACID NO.	.111	DEPTH OF CHILL
SILICON	2.02	2.00	2.02	SAP NO.	2.05	
NICKEL	1.52	1.56	1.42	IODINE NO.	7.12	GREEN STR. COMP.
CHROMIUM	.05	.07	.06	VIS.	.06	DRY STR. COMP.
MOLYBDENUM	.30	.24	.25	SP. GR.	.88	DRY STR. TEN.

REMARKS: Trans 69100 65750 69100 66350
1005 907 975 975

SIGNED: F.W.A. METALLURGIST

Fig. 19—Laboratory report on a high test iron used for producing cast crankshafts

ing gages, the blast control rheostats for measuring the pounds of air per minute entering the cupola. It might not be out of place at this time to mention that air pumped into the cupola exceeds by large measure the entire weight of fuel and metal.

Function of the large dial on the right is to register automatically the temperature of the flowing stream from the spout by the use of tube acting on the thermocouples leading onto the instrument. This instrument has proved to be very accurate when all conditions are constant, but apparently the accuracy is effected when the size of the stream is not constant or when there is a whirling motion of the stream from the spout. If it were deemed advisable to control these particular factors, there is no question but that the instrument could be used for accurate recording.

Starting of the cupola blower is done only in the blower room; but the stopping, either because of emergency or otherwise, is controlled at the panel board. Control of the cupola and its product is illustrated in Figs. 21, 25 and 28, pouring test pieces and chill specimens and taking iron samples from a ladle, of four different types of iron. Specimens are taken from every ladle. A number of tests are sent to the laboratory daily for chemical analysis.

Cupola slag plays a very important part, and in Fig. 30 slag is shown falling into a large bucket filled with water. A certain amount of water flows in and out of the bucket at all times to prevent overheating. When these buckets are filled with slag they are lifted out and replaced. Handling slag in this manner eliminates a

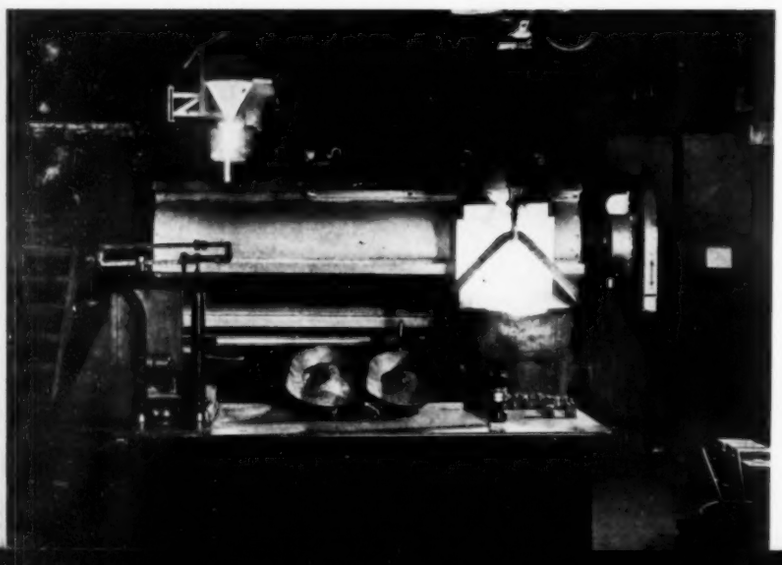


Fig. 20—Various alloys used in the charges are kept in pans and weighed out accurately on the scale shown in the foreground. Fig. 21 (Center above)—Pouring test pieces

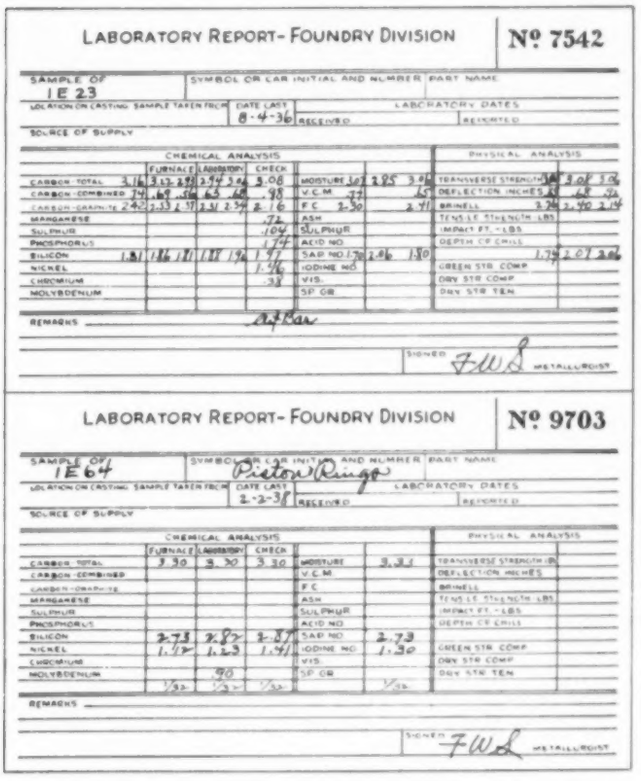
Control

By M. J. GREGORY
Factory Manager,
Caterpillar Tractor Co., Peora, Ill.

This is the second and concluding article of two abstracted from a paper presented by the author at the Sixth Annual Joint Foundry Practice meeting held in Birmingham, Ala. The first article appeared in the June issue

of this particular cupola, lined down to approximately 60 inches diameter, is 19 tons per hour.

Height of a cupola bed is a subject of much discussion and no two foundrymen have the same idea. At the Caterpillar plant we favor a relatively high bed in all



LABORATORY REPORT- FOUNDRY DIVISION — Nº 7542

SAMPLE OF: IE 23 | SYMBOL OR CAR INITIAL AND NUMBER | PART NAME
LOCATION ON CASTING SAMPLE TAKEN FROM | DATE LAST: 8-4-36 | LABORATORY DATES: RECEIVED | REPORTED
SOURCE OF SUPPLY

CHEMICAL ANALYSIS	FURNACE	LABORATORY	CHECK				PHYSICAL ANALYSIS			
CARBON TOTAL	3.16	3.12 2.93	3.14 3.04	3.08	MOISTURE	1.67	2.25	3.05	TRANSVERSE STRENGTH	3.06	3.06
CARBON COMBINED	.74	.69 .56	.60 .46	.98	V.C.M.	.77		.67	DEFLECTION INCHES	.08	.08
CARBON GRAPHITE	2.42	2.33 2.37	2.34 2.58	2.16	F.C.	2.30		2.41	BRINELL	3.34	2.90 2.14
MANGANESE				.72	ASH				TENSILE STRENGTH LBS		
SULPHUR				.104	SULPHUR				IMPACT FT.-LBS		
PHOSPHORUS				.174	ACID NO.				DEPTH OF CHILL		
SILICON	1.81	1.86 1.81	1.88 1.96	1.97	SAP NO.	1.78	2.06	1.80		1.79	2.07 2.26
NICKEL				1.56	IODINE NO.				GREEN STR. COMP.		
CHROMIUM				.38	VIS.				DRY STR. COMP.		
MOLYBDENUM					SP. GR.				DRY STR. TEN.		

REMARKS: 24 Bar

SIGNED: F.W.S. METALLURGIST

LABORATORY REPORT- FOUNDRY DIVISION — Nº 9703

SAMPLE OF: IE 64 | SYMBOL OR CAR INITIAL AND NUMBER: Piston Rings | PART NAME
LOCATION ON CASTING SAMPLE TAKEN FROM | DATE LAST: 2-3-38 | LABORATORY DATES: RECEIVED | REPORTED
SOURCE OF SUPPLY

CHEMICAL ANALYSIS	FURNACE	LABORATORY	CHECK				PHYSICAL ANALYSIS			
CARBON TOTAL	3.30	3.30	3.30		MOISTURE		3.31		TRANSVERSE STRENGTH LBS.		
CARBON COMBINED					V.C.M.				DEFLECTION INCHES		
CARBON GRAPHITE					F.C.				BRINELL		
MANGANESE					ASH				TENSILE STRENGTH LBS		
SULPHUR					SULPHUR				IMPACT FT.-LBS		
PHOSPHORUS					ACID NO.				DEPTH OF CHILL		
SILICON	2.73	2.87	2.87		SAP NO.		2.73				
NICKEL	1.47	1.23	1.47		IODINE NO.		1.30		GREEN STR. COMP.		
CHROMIUM					VIS.				DRY STR. COMP.		
MOLYBDENUM		.90			SP. GR.				DRY STR. TEN.		
	1/32	1/32	1/32				1/32				

REMARKS:

SIGNED: F.W.S. METALLURGIST

Fig. 22—Laboratory report on an iron used in the production of wet cylinder liners which are heat treated. Fig. 23—Iron employed for piston rings contains nickel and sometimes nickel and molybdenum

large part of the hot work. The slag is granulated to small size and eventually finds its way into gondola cars and to the dump.

The following discussion covers some of the irons used at the plant of the Caterpillar Tractor Co. Fig. 26 shows a day's report of cupola operations for a special iron used for cast iron crankshafts for diesel starting motors. Some of these have been in service for a long time and as yet no failure of any kind has been reported.

These charges are made up of 3000 pounds of metal, approximately 70 per cent steel, 15 per cent pig iron, and 15 per cent scrap. Temperature readings are taken every 15 minutes. In a measure the temperature, with other necessary observations, indicates how the cupola is working. This is similar to a doctor or a nurse taking patient's temperature in observing his condition.

Records also show the amount of coke and limestone per charge and pounds of air per minute. Melting rate

cases and we do not consider it unusual going up to 60 inches above the tuyeres. The material we use varies a great deal in size and causes quite a fluctuation in the melting zone.

Location of the melting zone and importance of keeping that melting zone at as nearly a constant level as

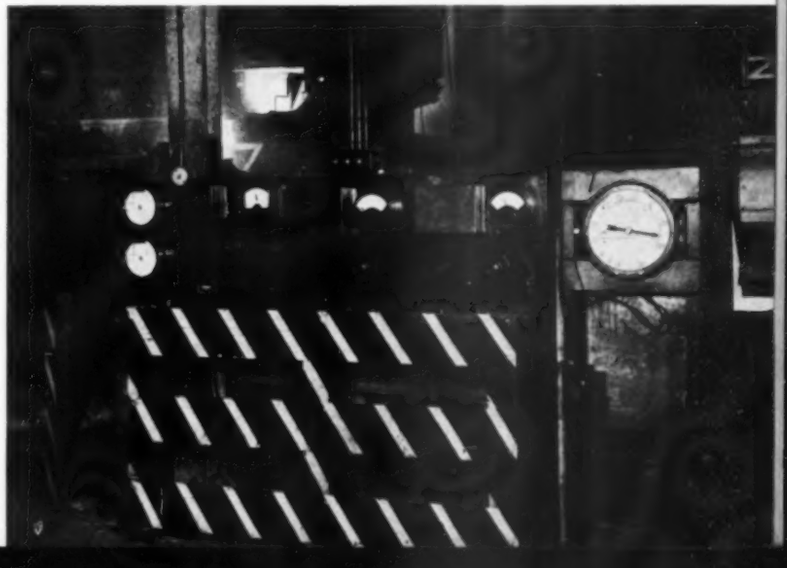
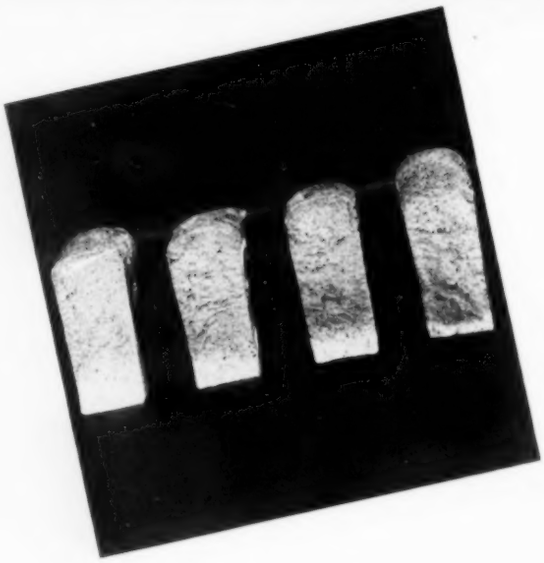


Fig. 24—Cupola control panel is within easy reach of the supervisor so that any changes can be made quickly as well as to provide constant observation



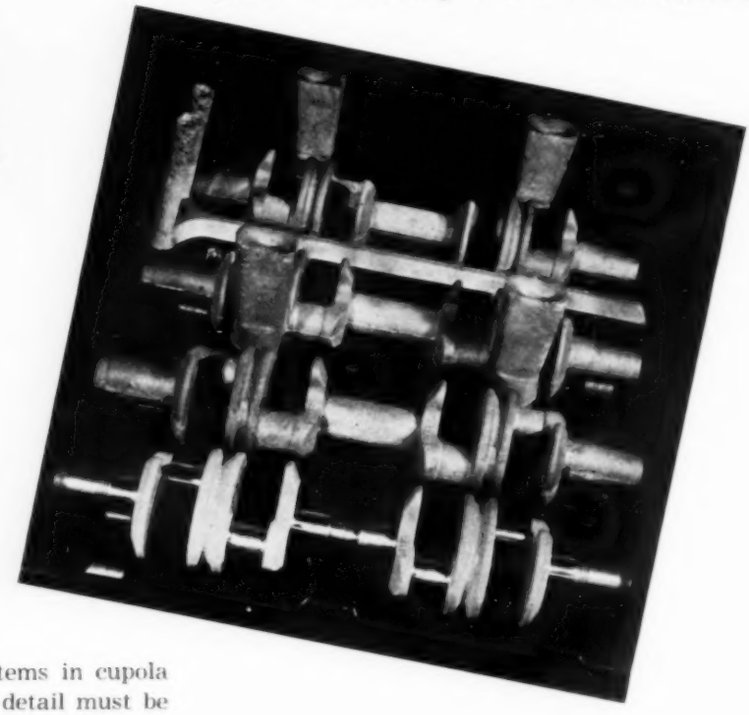


Fig. 25 (Above)—Broken chill test specimens. Fig. 26 (Below)—Table showing a day's report of cupola operations on a special iron used for cast crankshafts for diesel starting motors. Fig. 27 (Right)—Type of cast crankshaft made for the past nine years shown as it comes from the sand with the risers still attached

has many applications where the exceptionally high strengths of steel are not necessary. In a great many instances cast iron is proving that it is absolutely reliable for the work it has to perform.

Fig. 27 shows a cast iron crankshaft made at the Caterpillar plant over a period of approximately 9 years. The casting is shown as it comes from the sand, with the risers still on it. An iron of this nature requires risers. This particular point has been overlooked by some foundrymen who start out with the thought of increasing alloys but leaving off risers.

Foundrymen melting these high test irons need not be surprised if the casting yield drops to 50 per cent. Steel foundrymen, and malleable iron foundrymen possibly have a better conception of risers than the aver-

possible is one of the most important items in cupola operation. After lighting the bed, every detail must be watched carefully. Conditions during the first hour or two will govern the day's operation.

Very close observation and attention must be given to the cupola. Even with a 100 per cent steel charge it is possible to obtain a high carbon iron. Mere addition of steel to the cupola charge does not necessarily produce iron of good quality.

In the writer's opinion no cast iron, regardless of what it may be, can replace material such as steel and malleable iron for parts that absolutely require steel and malleable iron. Nevertheless high quality cast iron

Relative Humidity: 6 AM 8 AM 10 AM 12 N 2 PM 4 PM 6 PM
60 51 49 48

SPECIAL IRON

Tapped Out 7:10
Total Melt 158 tons

Time	Temp	Coke	Rock	Air & Press
7:15	2890	375	180	620
7:30	2860	375	180	620
7:45	2880	375	180	620
8:00	2900	375	180	640
8:15	2900	375	150	640
8:30	2860	375	150	650
8:45	2860	375	150	650
9:00	2860	375	150	640
9:15	2840	375	150	640
9:30	2840	375**	150	640
9:45	2860	375	150	640
10:00	2840	375	130	630
10:15	2840	375	130	630
10:30	2840	375	130	620
10:45	2840	375	130	620
11:00	2840	375	130	620
11:15	2840	375	130	620
11:30	Shut down 15 min. for lunch			
11:45	2800	375	130	600
12:00	2820	375	130	600
12:15	2820	375	130	600
12:30	2850	375	130	600
12:45	2850	375	130	600
1:00	2850	375	110	590

Coke Ratio 1-7.2

Time	Temp	Coke	Rock	Air & Press
1:15	2840	375	110	600
1:30	2810	375	110	600
1:45	2810	375	110	600
		(400)	(200)	
2:00	2810	375	110	580
2:15	2810	375	110	580
		(400)		
2:30	2810	375	110	580
			(200)	
2:45	2850	375	110	580
3:00	2840	375	110	580
3:15	2840	375	110	580
3:30	2830	375	110	600
3:45	2830	375	110	580
3:50	WIND OFF			

** 2 charges with 275 coke. Melting rate 19.1.

Note: Adding 25 pounds more coke on each charge on charging report.

Double coke on 3rd & 6th charges 200 extra rock on first 4 charges.

Diameter of melting zone at Starting time—58 inches.

age cast iron foundryman whose experience in this type of metal has been limited.

This particular casting, after it has been completely machined, is sawed in two. Note the heavy section in the center. Fig. 19 shows a laboratory report on this type of iron. Note especially the total carbon content and the silicon content. We aim at approximately 3 per cent carbon and approximately 1.75 per cent silicon at the spout. Later addition of silicon increases the silicon content to over 2 per cent.

Foundrymen generally are aware of the fact that there is virtue in the late addition of alloys, especially silicon. For increase in physical quality in this case we aim to get 1.50 per cent nickel and about 0.80 per cent molybdenum. Chromium is not desirable in this iron. Average tensile strength is considerably higher than 60,000 pounds per square inch. In this case the spread is from 65,000 to 69,000 pounds per square inch.

Attention is directed to the impact value of this particular iron. Our method of impact testing may be somewhat original and is not used to govern the industry in general. Up to the present we have not had a definite method of impact testing but we understand that a subcommittee of the American Society for Testing Materials is working on it. Naturally, our method of testing has been developed to meet our own situation. Ultimate object of the Caterpillar Tractor Co. is to manufacture and sell tractors and allied products.

Relative Humidity: 6 AM 8 AM 10 AM 60 12 N 51 2 PM 49 4 PM 48 6 PM

Tapped Out 9:20 — 1E18

Total Melt 132½ — Coke Ratio 1-7.15

Time	Temp	Coke	Rock	Air & Press	Time	Temp	Coke	Rock	Air & Press
9:30	2830	375	180	620	3:30	2820	375	130	580
9:45	2880	375	180	620	3:45	2850	375	130	560
10:00	2900	350**	180	620	4:00	2840	375	130	560
10:15	2860	350	180	620	4:15	2820	375	130	580
10:30	2860	350	180	620	4:30	2800	375	130	500
10:45	2880	350	150	620	4:45	2750	375	130	400
11:00	2880	350	150	620	4:55	Wind off			
11:15	2860	350	150	620					
11:30	2840	350	150	600					
11:45	2860	350	150	620					
12:00	2880	350	150	620					
12:15	2860	350	150	620					
12:30	2860	350	130	620					
12:45	2820	350	130	600					
1:00	2850	350	130	590					
1:15	2820	350	130	580					
1:30	2800	375 (400)	130	600					
1:45	2800	375	130	600					
2:00	2800	375	130	580					
2:15	2820	375	130	580					
2:30	2820	375	130	580					
2:45	2860	375	130	580					
3:00	2860	375	130	580					
3:15	2850	375	130	580					

** One 275 coke charge.
Melting rate 17.7
Note: Adding 25 pounds more coke to each charge on charging report.
Double coke on 3, 6, 9th charges.
200 extra rock on first 3 charges.
Diameter of melting zone at starting time—58 inches.

Fig. 29—Table indicating a day's report on another type of iron used in the foundry

Present method of testing answers our purpose and we believe there is virtue in this particular method. In this instance every casting poured from a ladle is kept separate. Physical quality must be obtained before the casting is released for production.

Table II shows a number of test bars with chemical and physical analysis. In this case we have an average of 83 foot pounds and tensile strength of better than 60,000 pounds per square inch. This is the same iron shown in Fig. 19 and shows the results over a period of several days. It is a fair average of analysis and physical properties of this (*Please turn to page* 74)

Fig. 28 (Left)—Samples of iron are taken from every ladle and poured into various types of specimens as indicated in previous illustrations

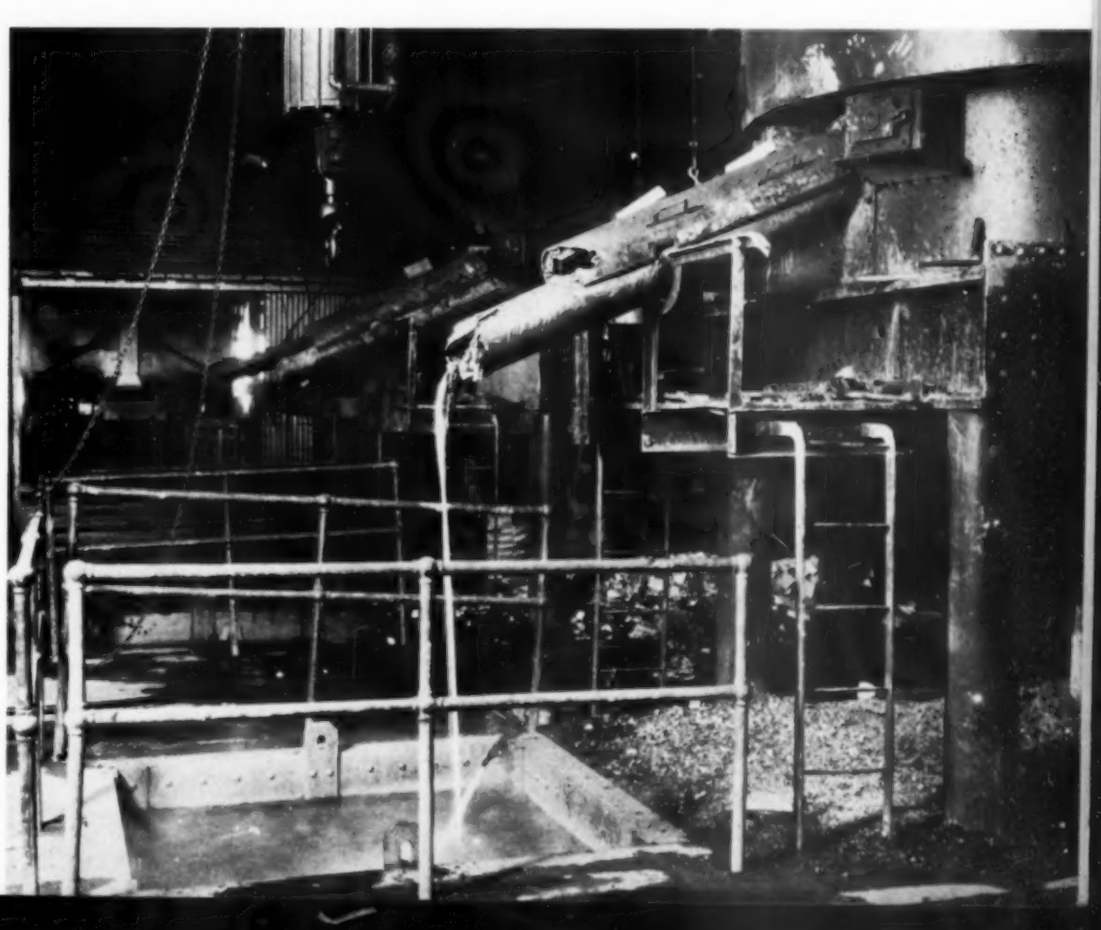


Fig. 30 (Right)—Slag from the cupola falls into a bucket containing running water which granulates it. The granulated slag later is placed in gondola cars and taken to the dump

MELTING Nonferrous Metals

By N. K. B. PATCH

WHERE monolithic linings are used it is important to dry them slow so that the moisture is evaporated, it does not generate steam with sufficient pressure to develop microscopical pores in the lining into which the molten metal may enter. Drying of the cement which is used to join firebrick or sectional linings likewise should be done slowly and carefully.

Orifices through which the gases are exhausted or through which the metal is charged or poured off should be formed carefully and well rounded. After a furnace has been lined, it should be slowly dried for at least 24 and preferably 48 hours. When it is dry the next step is to light the burner and gradually bring the furnace up to operating temperature. The temperature should be raised well up to the point where the surface is slagged over nicely. After that, the unit is ready for operation.

In operating cylindrical reverberatory furnaces, it is preferable to preheat the furnace before charging to avoid an excessive exposure of metal to furnace gases. The shorter time that the metal is exposed to furnace gases, the less chance it has for gas absorption. Obviously, heavy chunks of metal can damage the lining if they are put in the furnace carelessly. It is much better practice where small gates or risers are available, to lay a cushion of these on the hearth of the furnace, and then place the ingots and heavy pieces on top.

If there are no small pieces available with which to make a cushion, extreme care should be taken in inserting ingots and other large pieces of metal comprising the charge. A 20-pound ingot thrown carelessly in so that the sharp edges can dig the glaze from the furnace lining will reduce the life of the lining materially. While it may be considered a small expense to reline, it really is quite a large expense when shutdown time, drying time, preheating time, cost of new materials, and the necessary expense for proper supervision are taken into account.

As soon as the charge has been placed in the furnace, the burners are lighted again and the proper flame maintained. Of course, it is presumed that the charge will be distributed carefully over the hearth so that the flame may circulate throughout the furnace and combustion may be maintained under proper conditions. If this is not done, it is entirely possible to have a strongly reducing atmosphere in one portion of the furnace even though a definitely oxidizing atmosphere exists at other sections of the furnace.

On this account it is difficult to be sure that some of the metal is not subjected to the presence of reducing gases. Control of the furnace atmosphere is a vital factor where the flame is definitely and continuously in contact with the metal charged. Since the only method of routine control of furnace atmosphere is to watch the flame at the mouth of the furnace, it becomes a matter of practice and experience to operate the furnaces at their best.

Complete combustion (*Please turn to page* 77)

Refractory Service Increased Through Study of Problem

By S. M. SWAIN
North American Refractories Co.,
Cleveland

This article is from a paper presented before a regular meeting of the Wisconsin Chapter of the A.F.A. at Milwaukee

IT IS popular today to discuss the fact that we are living in a changing world. We say changes in the social order demand new attitudes on life's problems. Likewise all of us are aware that changes in the foundry industry have been as great as in any other field. We have seen increasing demands for high strength castings. Every day we are called on to meet demands for closer specifications and more rigid inspection of castings. Foundrymen constantly are striving to decrease production costs to meet keener competition.

Following this modern tendency there have been many changes brought about in the refractories field. These changes involve use of new raw materials, decided improvements in various manufacturing steps, and production of new classes of refractories made with these new materials or under these improved processes.

All these changes make it necessary not only to consider their influence today but their effects in the future. It is necessary for all of us to try to obtain a broader view of the present situation so we can evaluate the basic factors involved and make our plans accordingly.

Keep Open Mind on Subject

This article will point out one method of analyzing refractories problems with the view of assisting in your attempts to improve the service obtained. In going through the various steps of obtaining data it is extremely important to keep an open mind on the subject. This is necessary because conclusions drawn in regard to the service given by certain refractories in the past may be invalid in the light of conditions existing in the same furnace today.

The various steps in obtaining the data desired are as follows: 1. To determine the most apparent or likely destructive force acting on the refractories. 2. To determine other contributing factors. 3. To check the service factors and their relations to the problem. 4. To evaluate the data so obtained.

Necessity of attacking the problem in such detail may be questioned. In the first place, a satisfactory remedy never can be applied to any problem until the cause of the trouble is known. As has been stated, conditions existing at a previous time have been altered decidedly under present operating conditions and the various factors involved bear a different relationship to each other. Some conditions are far more severe than formerly, while others are of lesser importance. Finally, two destructive agencies present at the same time may call for exactly opposite properties in the refractory for a suitable solution of the problem. In such a case it is necessary to select a proper balance of properties in the refractories to overcome the trouble.

Study Condition of Cold Furnace

After the problem has been set down in specific terms, information and data bearing on the subject should be gathered. The furnace or cupola should be examined every time it is cold. A careful measurement of losses in various locations in the furnace will give a complete story as to the progress of destructive action. Examination of the refractory surface will give certain evidence as to the kind of destructive force operating in various parts of the furnace. Review of these data will locate positions in the furnace where various actions are most severe and will tell a history of the progress of these actions over the life of the refractory.

Probably the most valuable information which can be obtained will be available when the furnace is torn down for repairs. An examination of the cross section of the walls and arches at various points will give clues as to types of attack going on, their severity, and method of progress. From these cross sections, it is possible to find evidence of more than one destructive force which is playing a part in the difficulties. The study also provides data for estimating which one is the major problem and which are of minor importance.

Forces which are destructive to refractories in service may be divided into six headings, namely: 1.—Soften at high temperature; structural changes at high temperatures; spalling; abrasion; slag attack or solution; erosion. In general, each of these agencies leaves a clue which can be seen during the use of the refractory or in the portion left when the necessary repairs are made.

It is rare that a refractory fails due to softening at

high temperatures alone. However, when other agencies of destruction are present, as is so frequently the case in service, this softening may contribute its share toward failure. Of course, there are cases of failure due to softening when a refractory is not suited for the use in a given installation, as for example, when a second quality brick is used under conditions which demand that only a first quality brick be employed.

When softening at high temperatures is a contributing factor to failure, this failure is more severe when the furnace is operated for a long time under the highest temperatures of service. During short heating periods, up to 8 hours, the heat flow in the refractory does not reach equilibrium, and the relatively higher flow of heat away from the hot surface protects that surface to a marked degree. Use of insulation on the outside of furnace walls slows up the heat flow through that wall and thus allows the inside surface to heat up more rapidly, and for that reason may increase the severity of the destructive force.

Depends on Mineral Composition

Softening of the refractory under high temperature service, does not depend on its chemical composition as such, but rather on the mineral content of the finished brick, which in turn is dependent on the mineral content of the raw materials used in its fabrication and the heat treatment it received during firing. The pyrometric cone equivalent is a more reliable index of this softening under heat, but even this does not tell the entire story.

Characteristics of refractories which have been heated beyond the temperature in which they can give satisfactory service may vary with certain other factors. If the refractory has been placed in a side wall or other position where it is not under pressure, the overheated zone will appear vesicular, that is, will show the presence of spherical voids or tiny bubbles, size of bubbles increasing with the amount of overheating. If overheating has not been excessive, or if the hot portion of the refractory is under load, the overheated portion will be glassy or vitrified. On the other hand, vitrification may be brought about by other factors so that this appearance cannot be taken as evidence of softening due to high temperatures alone.

Fire clay or cements which have been used for laying the refractory may actually soften under heat and cause considerable trouble. When the temperature has been carried only slightly above a safe limit the cement will be well vitrified and show signs of bulging out of the joint. As the temperature is increased the outer portion will soften enough to run, and in some cases of excessive misapplication of the joint material, may actually attack the refractories.

Structural changes at high temperatures involve an adjusment in the structure of the refractory similar to changes taking place during the original firing of that product. Today almost all refractories intended for high temperature service are fired hard enough to insure any such change. However, there are certain products, which give better service under average conditions when supplied in a soft or medium-to-hard burned quality. One outstanding case of such a condition involves hand made bung brick. There are certain types of furnaces where such brick gives better service than the harder burned dry pressed bung. There are borderline cases in which the temperature of operation has been increased following certain demands in the industry. Under past performance medium to hard burned hand made bung have given satisfactory service. Under the changed conditions of operation involving higher temperatures this brick may no longer give satisfactory service due to the fact that the hot face of the bung brick has been altered by the higher temperatures under changed conditions. These higher temperatures have caused the hot face of the bung brick to shrink, setting up strains which result in increased spalling during the heating of the bung.

This change in structure under high temperature service does not leave outstanding evidence of its occurrence, and is frequently confused with thermal spalling. Sometimes the changes in structure are accompanied by change in color, particularly by darkening of the changed zone. These changes in color, however, are frequently brought about by reducing conditions in the furnace and do not indicate conclusively that structural changes have taken place.

Spalling is one of the chief causes of failure in refractories, not because of its severity alone, but because it acts after other destructive forces have brought about their change. For example, the surface of refractory may be impregnated with a slag which results in the formation of large amounts of glass between the refractory grains. Such a combination is susceptible to sudden temperature changes and the refractory spalls when such changes occur. Again, the bond in the refractory may be loosened or partly destroyed by abrasion. Later, this weakened bond allows portions of the refractory to spall off when a thermal shock occurs.

Improper Drying Causes Spalling

There is one type of spalling which occurs frequently in cupolas and which is not caused by thermal shock or structural change. This spalling arises from improper drying of the refractory or the patch. Rapid heating of the cupola suddenly turns the moisture in the refractory to steam with such force that it blows off pieces of the surface. Great care usually is taken in the installation of these patches and then all is rendered ineffective by anxiety to get the furnace hot as fast as possible. The patch, intended to protect the refractory, is now in the well and large amounts of limestone must be added to flux it away, thus increasing the severity of service on the cupola blocks instead of of decreasing it.

Characteristic appearance of a refractory which has spalled is the presence of a rough surface in which the coarser grains are exposed but in which the back of these same coarse grains are quite well bonded. In other words, the fracture through the refractory passes around the coarser grains. In fine-grained dense refractories the spalling fracture may pass through the grains. In such cases the spalled surface is rounded or tends to follow the thermal planes existing in the refractory.

Abrasion may be a major destructive force without this fact being realized because (*Please turn to page* 78)

Practice Problems

Feature Convention

AN EXCEPTIONAL program of technical papers was presented at the forty second annual convention of the American Foundrymen's association held in Cleveland, May 14, to 19. A wide variety of problems touching every phase of foundry activity featured the convention sessions. Reports of meeting on sand research, refractories, material handling equipment, costs, cupola melting, molding and core sands, malleable cast iron furnace practice, and job evaluation, are presented in this issue of THE FOUNDRY.

The illustration above shows the large number of foundrymen at the buffet supper in Public Auditorium, Tuesday evening, May 17.

Consider Features of Sand Research

The sand research session held Wednesday, May 18, was under the supervision of R. F. Harrington, Hunt-Spiller Mfg. Co., Boston, as chairman, and Harold W. Johnson, Greenlee Foundry Co., Chicago as vice chairman. A paper, "Effects of Different Electrolytes on A.F.A. Clay Determinations," by J. F. Haseman, Cornell university, was read by Dr. H. Ries, Cornell university. This paper described work undertaken with the object of determining what effect electrolytes other than sodium hydroxide might have in making A.F.A. clay determinations and what results different amounts of them might give. In conclusion it was stated that it would seem safe to say that for the A.F.A. determination sodium hydroxide probably is the best all-around electrolyte and the three per cent concentration now recommended by the committee on standards tests is quite satisfactory.

In the discussion which followed Dr. Ries stressed the fact that the distilled water used in the tests should be neutral, that is neither acid or alkali. When ordinary water from city mains or other sources is used, Dr. Ries pointed out, the results are of little value.

H. L. Dash, Iowa State college read a comment on the paper and outlined methods followed in determining clay sizes. In working on different sands he pointed out that it was advantageous to siphon the water often as many as 30 times.

"What Happens To a Core in a Core Oven" was the title of an interesting paper read by Jasper Willsea, the Willsea Works, Rochester, N. Y. Mr. Willsea discussed the importance of water in drying and baking cores and explained his theory of oven exchange temperatures.

M. A. Dierking, Ohio State university presented a written comment on the paper, illustrating his comment with lantern slides. He gave the results following the use of thermocouples in the cores to record drying temperatures. He also showed graphs to stress the results of these tests.

George Binns, Cincinnati (*Please turn to page* 56)

Alloy Steels

Designed For Specific Uses

By VINCENT T. MALCOLM
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SPECIAL steels may be divided into a number of classes as follow:

Steels which are necessary for added strength and toughness and which may be classed by their carbon content, heat treatment and the alloy used, such as nickel, chromium, molybdenum, vanadium, manganese and others.

Steels for resistance to wear, which are governed by the use of high carbon or medium carbon plus heat treatment, or whose properties are governed by the alloy additions, such as manganese, chromium, nickel, tungsten, etc., and by heat treatment.

Steels to resist creep and elevated temperature, which are governed mostly by carbon content and alloy additions of chrome, nickel, manganese, tungsten, molybdenum and vanadium.

Steels for welding, which are governed by their carbon content plus certain alloy additions of molybdenum, tungsten, nickel and vanadium.

Steels primarily for resistance to corrosion and oxidation. These contain large percentages of chromium, chromium with nickel with or without additions of tungsten, molybdenum, copper, titanium and vanadium.

Carbon Content Is Low

Steels that are free machining and nonseizing. These are usually of high alloy content, such as chrome, and chrome and nickel, and are rendered free machining by the addition of zirconium, selenium, columbium, titanium, and nitrogen. Carbon in these various types of steel is usually kept quite low.

The alloying elements most commonly employed in steel casting are nickel, chromium, manganese, molybdenum, tungsten, and vanadium, and it is not our idea to enter into a discussion as to the special properties imparted to steel by any one of these various elements, except to touch briefly upon the several elements.

Chromium combines with the carbon of the steel, forming carbides of high strength and hardness. At the same time, it tends to produce a fine structure, increasing the tensile strength. With the use of both nickel and chromium, steels may be produced possessing desirable qualities inherent to each element. The ductility and toughness conferred by nickel are combined with the strength and hardness imparted by chromium.

The characteristics of the two elements suggest that a constant ratio of nickel to chromium always should be maintained to obtain the proper combination of strength and ductility. Experience has shown that a nickel chromium ratio of 2 to 2½ to 1 constitutes the best balance for steel castings. These steels respond readily to heat treatment and extend the field of usefulness to a wide range of application.

Chromium-nickel steels are used for a vast variety of purposes, such as valves and fittings for high temperature service, both in steam station and refinery operation, for track shoes, sprockets, return bends, oil well equipment, railway equipment, and other miscellaneous castings requiring high strength combined with great toughness. The increase of the chromium content between 4-6 per cent with the addition of tungsten or molybdenum produces excellent castings for refinery service.

High chromium alloys of 11-14 per cent produce the stainless varieties which respond readily to heat treatment, while the 18 per cent and 28 per cent chromium types are used for both oxidation and corrosion resistance. High chrome steels, with the addition of nickel, form the austenitic type of alloy

This is the first article of a series of three abstracted from a paper presented by the author at the Northwestern New York Regional conference held at Cornell university Ithaca, N. Y. The second article will appear in an early issue

which is nonmagnetic and not hardened by heat treatment. These types of steel are highly resistant to oxidation and chemical attack.

Nickel is usually present in steels as a solid solution of nickel in iron and does not form a part of the brittle constituent, cementite. When present in low and medium carbon steels, it tends to produce a fine grained ferritic structure and to refine the structure of the perlitic areas, therefore, bringing about an increase in strength without decrease in ductility. It tends to inhibit grain growth and lessens the danger from overheating during treatment.

Ordinary carbon steels, when heated above the critical temperature for considerable lengths of time, usually exhibit grain growth accompanied by considerable decrease in impact properties, while nickel steels are affected to a lesser degree. The plain nickel steels with 2.75 to 3.50 per cent nickel are used primarily for valves and fittings for low temperature operation, that is, to minus 75 degrees below zero. They are also used for hydraulic press cylinders, locomotive driving wheel centers and rods, crane castings, and many types of miscellaneous castings.

In the low pearlitic steels, manganese usually is added primarily as a scavenger. However, manganese has been used with success in steel castings; the manganese content running approximately 1.25 per cent. Combined with molybdenum, manganese forms an excellent steel, having high shock resistance and excellent creep properties under high temperature. Combined with vanadium, manganese also shows excellent results. High manganese of 10-14 per cent forms an austenitic steel and is used to a great extent in parts that are subject to great wear.

Molybdenum steels have developed quite rapidly. To obtain the best results, it is usually necessary to add some other element, such as nickel or chromium, or a combination of nickel and chromium. Steels besides the straight carbon-molybdenum are manganese-molybdenum, nickel-molybdenum, or nickel-chromium-molybdenum. All these steels give excellent service in castings where high strength and high elastic properties, combined with excellent ductility, are required.

Steel Adaptable for Large Castings

The nickel-chromium-molybdenum and the chromium-molybdenum types lend themselves readily to air quenching treatments and are well adapted to the production of large castings, because of their deep hardening properties. Molybdenum steels are used in many industries where resistance to creep and oxidation is a prime factor. The straight carbon molybdenum steels are especially adapted for welding, provided the carbon is kept below 0.25 per cent as their creep resistance is high.

Vanadium usually added to steels in amounts under 0.30 per cent, is a powerful deoxidizing agent, and it is believed that most of the beneficial effects in steel castings in which vanadium has been alloyed are due largely to elimination of impurities. When vanadium is added to steel castings in these proportions, a small part is believed to dissolve in the ferrite, while the major portion is certain to combine with cementite to form complex carbides. Steel castings containing nickel and vanadium show excellent physical properties such as strength and elastic limit, with high ductility. Grain refining effect of vanadium makes vanadium steel especially desirable for highly stressed castings of heavy sections.

Tungsten, particularly when alloyed with chromium and used for high temperature applications, produces excellent results in stability, either above or below the equi-cohesive temperature. Tungsten combines with carbon, rather than with iron, and exerts a strong effect, being essentially a carbide former. It lowers the eutectoid per- (*Please turn to page* 80)

QUESTIONS and ANSWERS

Bushing Defect Is Traceable To Blowing From the Core

We are making bronze bushings 5⅝ inches inside diameter, 8¼ inches outside diameter and 5⅛ inches high from the following composition: Copper 77 per cent, tin 7 per cent, lead 15.75 per cent and phosphorus 0.25 per cent. The castings apparently are sound leaving the sand, but the machining operation discloses a mass of blowholes immediately below the surface, with other blowholes here and there throughout the casting. The metal is poured at a temperature between 2100 and 2200 degrees Fahr. The trouble may be due to faulty manipulation of the oil burner in the furnace, but this theory is not convincing in face of the fact that other castings from the same composition and melted under the same conditions are quite satisfactory.

If all castings poured from a certain composition and from a given furnace were filled with blowholes you might be justified in suspecting that the melting process was at fault. Since a certain number of the castings are satisfactory, it is apparent that the cause of defects lies elsewhere.

Suspicion in this case points rather strongly toward the cores. To convince yourself on this point, pour a few castings in open molds so that you may watch the metal as it rises. If the metal does not lies quietly against the cores you can expect to find blowholes in the casting. The remedy is to provide cores of a more permeable character. Possibly you are adding too much binder, either in the form of new molding sand, or in artificial binder. Instead of a solid core, it is advisable to use a shell, say about 1-inch thick. The large hole in the center will permit the gas to escape readily.

Size of Tuyeres Is Important Factor in Cupola Melting

Our 48-inch diameter cupola at present is provided with six tuyeres, each with an area of 98 square inches at the mouth and an area of 60 square inches at the wind belt. We are putting in a new set of tuyeres. Should we increase the area of the opening at the wind belt, and if so, how much?

Melting speed of a cupola depends on the volume of air entering in a given time. Increasing or decreasing the tuyere openings will not affect this speed to any appreciable extent. This statement of course is predicated on the assumption that the tuyere openings are a reasonable size in the first place. Where the tuyeres really are too small, the required amount of air may enter the cupola, but the intensity of each jet will chill the coke and slag in the immediate vicinity and thus promote the formation of a bridge. On a short heat this factor may not be of any importance, but it is fatal on a long heat. The flared type of tuyere is designed to minimize this jet effect. The usual ratio for tuyere area is 1 to 4 or 5.

That is, the combined area of the tuyeres is equal to ¼ or 1/5 the cross sectional area of the cupola at the melting zone. In your present arrangement the combined area of the tuyere openings at the shell is 360 inches. The cross sectional area of the cupola is 1808 square inches. This means that your tuyere area equals one-fifth of the cross sectional area of the cupola. A 48-inch cupola has a normal melting capacity of approximately 9 tons per hour on a consumption of approximately 270,000 cubic feet of air, or 4500 cubic feet per minute. Six tuyeres 5 x 12 or 6 x 10 inches will admit that much air readily. Enlarging the size of the tuyere opening means cutting a larger opening in the shell of the cupola and we doubt if it is worth the trouble and expense. However, if you care to try the experiment we suggest raising the height, rather than the width of the tuyere by an inch.

Sufficient Binder Is Required In Dry Sand Mold Facing

We are using new Albany No. 1 sand bonded with molasses water for facing on some dry sand molds. We mix 1½ quarts molasses with 10 gallons water. The molds are dried from 10 to 12 hours. In some instances the sand is satisfactory, while in other instances it cuts badly. We shall appreciate your advice on a proper facing sand mixture.

Based on the statement that the sand washes in some of the molds and does not wash in others, it is apparent that the dry sand strength of the facing mixture is just on the border line. Usual method of increasing the bond is to add varying amounts of cereal binder and clay. If too much is added the remedy defeats its own purpose, first because the hard skin is inclined to scab or blister, and second because

addition of these bonding materials reduces the refractoriness of the facing sand. On light castings the refractory factor is not so important, but it must be taken into consideration in a mold for a heavy casting. For that reason a little experimenting usually is necessary in developing a proper facing sand.

However, in the present instance with No. 1 Albany sand for a base, presumably used on medium weight castings, a satisfactory facing sand will contain 20 parts sand, 1 part cereal binder and 1 part fire clay. The clay is added in the form of claywash in which the water contains your present proportion of molasses, that is 1 to 26.6. The extra amount of binder in this facing sand reduces the permeability, therefore it is essential that the backing sand should be more open or permeable than usual.

The foregoing is based on the assumption that when you refer to a wash, you mean that the sand in some instances was washed or eroded by the flowing metal, thus indicating lack of bond strength. However, if by wash you mean a general dirty and scabby surface, that means a different problem altogether and may be due to a variety of causes, including weak sand, lack of vent, improper ramming or molds that are not sufficiently dried.

Cupola Supplies Hot Iron But Melts too Slowly

Our 19-inch diameter cupola melts hot iron, but it melts too slowly and also bridges above the tuyeres. We shall appreciate your advice on the proper size and number of tuyeres, volume and pressure of blast, weight of iron, coke and limestone in the charge.

To melt hot iron is the most important function of a cupola and the next most important is to remain full size inside all through the heat. The second feature is relatively unimportant on heats that are run off in an hour or less, but becomes exceedingly important on heats extending over 2 or more hours. Since you do not state the length of time the cupola is in blast, or the amount of iron melted in a given period, we can not offer an opinion on whether the cupola is or is not operating to capacity. Bridging above the tuyeres is caused by an accumulation of slag. Obviously the remedy is to provide an agent to liquefy this slag and then provide a slag hole or slag skimming spout through which the liquefied slag can be removed either intermittently or steadily.

Limestone is the agent usually employed. Some foundrymen prefer a slag hole at the back or side of the cupola, while others prefer to draw metal and slag through the tap hole and separate them in the spout. Size and number of tuyeres may vary to quite an extent without affecting the normal operation of the cupola. Volume and pressure of blast are the determining factors. In the present instance the following items are submitted for comparison with your present setup and method:

Melting capacity per hour, 2000 pounds; cubic feet of air per minute, 500; pressure, 4 to 6 ounces; total tuyere area, 32 inches (Two diametrically opposite tuyeres each 2 x 8, or 4 x 4 or 4½ inches diameter); bed coke, 36 inches above tuyeres; intermediate coke charges, 40 pounds; iron charges, 350 pounds, and limestone on all charges, 15 pounds. If the cupola is not provided with a wind belt, a branch from the main blast pipe is extended to each tuyere. This represents merely a general outline. For a proper understanding of cupola construction and operation we suggest reading *Melting Iron in the Cupola*, by J. E. Hurst, which may be purchased from the book department of THE FOUNDRY.

Describes Steel Scrap Effect On Cupola Mixture

Is the use of steel scrap or nickel detrimental in a cupola mixture where the resulting iron is poured into castings used as molds for glass, aluminum, zinc or other nonferrous metals.

Steel scrap loses its identity when melted in a cupola charge. Without entering into all the details, it is sufficient to say that the resulting metal is cast iron. Provided the amounts of the component materials in the charge are proportioned to yield the anticipated analysis in the casting, it does not matter whether the metal entering the cupola is steel or iron. A proper discussion of the subject with all the chemical reactions involved would extend too far into the metallurgical field to be covered at the moment. Briefly, and probably sufficient for your present purpose it may be pertinent to state the only basic difference in steel and cast iron is in the carbon and silicon content of each.

Thus while the average gray iron contains 3.30 per cent carbon and 2.50 per cent silicon, steel contains only 0.35 per cent silicon and carbon from 0.15 to 0.80 per cent. The higher carbon content is found in rail scrap, the usual material in a cupola charge. In making up a cupola charge the carbon feature may be ignored, since steel in the molten condition will absorb sufficient carbon from the coke. The silicon content must be adjusted in the charge to compensate for a melting loss of approximately 0.25 per cent, in addition to making up for the low silicon content in the steel part of the charge.

In a typical example a 1000-pound charge containing 80 per cent iron and 20 per cent steel, the silicon content of the iron is 2.50 per cent and the silicon content of the steel is 0.80 per cent. The resulting metal will show a silicon content of 2.16, less the melting loss of 0.25 per cent, or 1.91 per cent. Manifestly, if a higher silicon content is needed in the castings, the silicon content in the charge must be raised either by the addition of higher silicon content pig, or by the addition of the required amount of ferrosilicon. Instead of being detrimental, the addition of nickel in properly discretional amounts, is regarded as highly beneficial in practically all classes of gray iron castings. However, the best results from nickel additions are secured when the base mixture or charge is calculated properly.

Loose Sand Causes Dirty Castings

We are forwarding a number of polished brass castings, also a number of sketches showing the method of gating employed. You will note the castings are pitted and therefore cannot be polished to a perfect surface. We shall appreciate your comment on whether the gating system or some other cause is responsible for the defects showing on the faces of the castings.

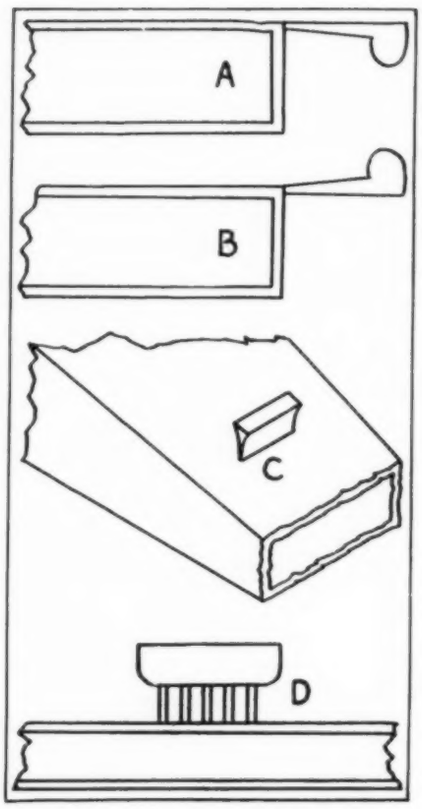
The gating system in itself is not responsible for the pits on the faces of the castings. Briefly, the castings reflect careless molding practice. Pits are caused by particles of sand washed into the mold with the metal. Presence of these loose particles of sand may be traced to any one or a combination of several causes. Under ordinary conditions these minor imperfections would arouse no comment, therefore it is possible that the present foundry technique is not up to the standard required for the production of perfectly clean castings. A general tightening up and closer supervision may be required.

The most probable source of the loose sand is a rough sprue, especially if the sprue is cut in the usual manner with a sprue cutter. If the sprue cutter encounters a piece of scrap or hard lump, it leaves a rough, ragged surface and the falling metal carries loose particles into the mold. With a set sprue or gate stick, the sand may not be packed to the proper density around it. The metal washes some of it away. If the sand in the mold, especially around the sprue and gates is low in bond, it will not resist the erosive action of the metal. If the sand is too dry the metal washes some of it from the surface. If the sand is too wet, the boiling steam loosens some of the particles and they float along with the stream. To sum up the situation, your problem simply resolves itself into the adoption of practice that will prevent the metal from picking up loose sand particles and carrying them into the mold.

Gates to Blame for Leaking Area

In the *Question and Answer* section of a recent issue of THE FOUNDRY we noted a reference to an aluminum pressing head casting leaking around the gate area. We shall greatly appreciate a sketch illustrating the proposed remedy.

As we pointed out in the item to which you refer, in some instances a gate causes a casting to leak by pulling metal away instead of feeding metal into the casting. This almost invariably happens where the gates are backed by a heavy runner in the drag as shown at *A*. The runner should be in the cope as shown at *B* so that gravity may have a chance to force the metal toward the casting while it is solidifying. Alternative methods of gating the casting are shown at *C* and *D*, the first a wedge gate and the second known as a pencil gate. In the particular case under discussion, two or possibly three of these gates will be required.



The gate at A draws metal from the casting. Runner should be in the cope as at B

Core Sand Re-use Is Debatable

We produce a considerable tonnage of gray iron castings in dry sand core molds. At present we re-use a small quantity of this sand, but the greater part is discarded. We have no equipment for removing fines and carbonaceous material. We shall appreciate your opinion on the feasibility of re-using a greater quantity of the material.

A careful survey of all the factors and conditions in any given plant will determine whether the use of discarded core sand is more economical than the use of new sand. So far as the material is concerned the used sand is just as satisfactory as new sand for many types of cores, for example the comparatively chunky cores that form the outside of a mold. The principal factor is the labor cost involved in collecting the broken cores, removing rods and wires, maintaining separate bins in the vicinity of the coremaking stations, and the additional time required to fill the coreboxes from two separate bins instead of filling the box from, for example, an overhead hopper.

In practice the inside of the corebox is faced with the regular core sand mixture and then the remainder of the box may be filled with the reclaimed sand. Where a muller type of mixer is available the old cores readily are broken down under the rollers. Even if some of the sand is not broken down to grain size, that will not affect the final result. The inside of the core faced with the regular core sand mixture will be smooth and clean and that is the only part of the core that really matters. If a muller type mixer is not available the broken cores may be loaded into a tumbling barrel with a number of cast iron balls, short lengths of steel shafting or miscellaneous scrap. An exhaust pipe attached to the mill will remove all the fines. On the latest type of mullers an exhaust system performs the same function.

Computes Weight of Alloying Agents

In making a casting weighing 1200 pounds what would you use to obtain 3 per cent chromium, and 1 per cent nickel in the borings from the casting? If being made, what percentage of 96 per cent nickel and 65 per cent chromium would you add to the charge to obtain the results desired in the borings? The chromium and nickel are to be added to the charge in the cupola with no other iron charged.

While you refer to a weight of 1200 pounds, it is difficult to determine whether you mean that to be the weight of the casting itself, or whether it constitutes the total weight of the charge to be employed for making the casting. If the 1200-pound figure refers to the total weight to be placed in the cupola, determination of the nickel and chromium to be added is comparatively simple. However, if the 1200 pounds refers to the casting itself, it will be necessary to know how much iron in addition is placed in the cupola for gates, risers, etc.

Since nickel can be melted in the cupola without oxidation loss, all that is required in the calculation is to multiply the weight of iron in the charge by the desired percentage of the alloy. The result ob-

tained then is divided by the actual percentage of the element in the alloy which is added. The result of that division gives the actual quantity of the alloy to be added to the iron.

In the case of nickel, the calculations are as follows: 1200 × 0.01 = 12.00 12 ÷ 0.96 = 12.5 or the amount in pounds of 96 per cent nickel to be added to a 1200 pound charge to give 1 per cent nickel in the final iron.

Chromium, however, is subject to oxidation losses when added in the cupola unless it is protected in some manner. One method of protection that has been employed with some success is to enclose chromium in metal containers, but the one most generally employed is that in which the ferrochromium is encased in cement briquets. Use of the latter is suggested since they are easy to handle and contain a definite amount of chromium, namely 2 pounds of chromium metal, not 2 pounds of ferrochromium.

Calculation of the chromium is as follows: 1200 × 0.03 = 36 and 36 ÷ 2 = 18 or the number of briquets to be added for 3 per cent chromium in a 1200-pound charge.

Defective Area Is In Casting Bore

We find a shrinkage area about the center of the bore of a casting 9½ inches diameter at the top, 11¾ inches diameter at the bottom, 36¾ inches in length, with a 5-inch diameter core in the center. A long sprue conducts metal to a gate at the bottom of the casting, with an auxiliary gate near the top from the same sprue. We have the same trouble with a bushing 12 inches in length, 5¼ inches outside diameter and 2 inches inside diameter molded on end and gated through a single gate cut in the joint at the top. We place a single fairly large riser on the small bushing, and two similar risers on the large casting.

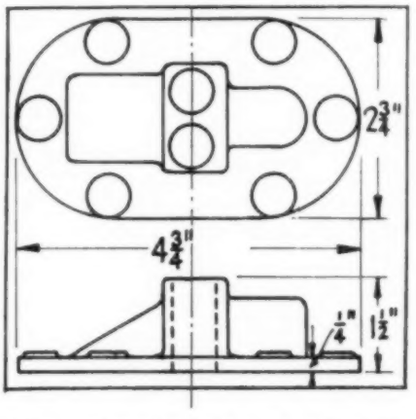
Your gating system conforms to ordinary practice provided the bottom gate is set at a tangent to impart a whirling motion to the metal. Since the casting is of uniform section throughout and therefore should shrink uniformly, we are inclined to doubt your diagnosis that the defective area is due to shrinkage. The defective area in the casting more probably can be traced to one of two causes, or possibly a combination of both. The first is foreign material, slag from the iron or sand washed from the sprue.

The second prolific cause of a defective area of the character indicated, is a core which causes the metal to boil. This boiling action creates a scum and a collection of bubbles. Some of the gas escapes through the metal, but some of it is trapped in the scum which solidifies rapidly and sticks to the core. Obviously the remedy for the first condition is to provide a sprue and gate that will not wash. The remedy for the second is to provide a core from which the gas can escape readily, a core against which the metal will lie quietly. Incidentally, while the bottom gate is fairly satisfactory, it introduces a hazard in the long passage. Also by constantly introducing hot metal at the bottom, it acts in opposition to the natural tendency of a casting to start solidifying from the bottom. A ring of pop gates on the top is preferable.

Risers Do Not Feed Heavy Portion

We are sending for your inspection a sample casting and a sketch showing the method of gating. As you will note 6 castings are made in a 12 x 16-inch flask employing a 1½-inch diameter sprue with a ¾-inch runner. Centered above the runner and each pair of castings we are using 1½-inch risers. At present we are molding the castings with the heavy boss in the cope, and have a loss from 50 to 75 per cent which takes the form of a shrinkage area in the lower part of the heavy section. Gating is through the flange, and we have tried molding the castings with the heavy section in the drag without any noticeable improvement. The trouble is eliminated when the castings are molded in the latter position by placing a 2-inch riser over the heavy section, but our cleaning costs will not permit that method. The alloy contains 83 per cent copper, 6 per cent tin, 4 per cent lead, 7 per cent zinc, and 0.75 per cent nickel. Pouring temperature is 2100 degrees Fahr.

Difficulty with the castings you mention is due to lack of proper feeding, and that is amply proved by the remarks you make relative to change of position of the casting in the mold, and to the results obtained by employing a riser over the heavy section. Your present method of gating shows that risers have little value as far as feeding the casting is concerned, if they are not located so that the molten metal enters directly into the section requiring feeding.



Heavy portion in center of the casting must be fed by a riser placed over it

Consequently, in order to obtain sound castings, it will be necessary for you to change the position of the risers from over the runner to over the casting. The flange through which you gate is only ¼-inch thick while the heavy section is about 1⅛ inches average thickness. While the more logical procedure of molding the casting would be to place the heavy section in the drag to gain increase in the head of metal, it will be more costly to remove a riser from the flat portion as you indicate.

Therefore, it is suggested that you mold the casting as you do at present with the boss or lug in the cope; employing a very shallow drag, and at least a 4-inch cope. The riser should be placed over the highest part of the casting, and should be about the same cross-sectional area of that part or ¾ x 1½ inches. It may be well to neck in the riser slightly at its juncture with casting proper to indicate to the cleaning department exactly where the riser is to be cut off so that no encroachment is made on the casting. If you do not want to place the riser as indicated, you could locate a circular riser about 1⅛ inches in diameter over the rounded portion just adjacent to the highest point.

Apply Abrasive to Safety Tread

Can you give us any information on the methods employed in applying an abrasive material to the mold for producing of abrasive coated, cast iron safety treads?

Abrasive coated treads are produced by coating the mold face with silicon carbide or aluminum oxide grain ranging from 12 to 30 mesh in size. After the pattern is drawn the mold face is sprayed with a thin solution of waterglass (sodium silicate), molasses or clay wash. Then the abrasive is screened over the surface through a sieve of approximately the same mesh size as the abrasive so as to obtain a thin, uniform coating. A second spraying and coating of abrasive is applied, and then the mold face is skin dried or baked so as to prevent any kicking of molten metal. Metal used should be as hot as possible to insure good penetration between the abrasive grains, and a partial fusion or slagging of abrasive and binder.

Prof. Kenneth M. Donaldson

Dr. Cecil H. Desch

C. B. Saunders

R. E. Wilke

MEN of INDUSTRY

R. E. Wilke, foundry metallurgist, John Deere Tractor Co., Waterloo, Iowa, recently was elected president, Northern Iowa Foundrymen's association. Mr. Wilke was born in Bennett, Iowa, in 1905, attended public schools at Tipton, Iowa and received his degree from the State University of Iowa, Iowa City, Iowa, 1928. From 1928 to 1935 he was chemist, Chicago Malleable Castings Co., West Pullman, Ill. In March, 1935 he became connected with the John Deere Tractor Co., Waterloo, as foundry metallurgist in charge of melting and sand control. Mr. Wilke is a member of the American Foundrymen's association. He served as vice president of the Northern Iowa Foundrymen's association from April, 1937, to April, 1938, when he was elected president. During the recent convention of the American Foundrymen's association, he led the discussion at one of the shop courses on "Practical Problems of Gray Iron Sand Control."

♦ ♦ ♦

Charles B. Saunders, newly elected chairman of the Birmingham district chapter, American Foundrymen's association, was born in Memphis, Tenn., and received his early schooling in Decatur, Ala. While attending school he worked part time for the Tennessee Coal, Iron & Railroad Co. In 1911 he became a full time employee and has seen continuous service with that company, with the exception of 2 years when he served in the army during the World War as first lieutenent and captain in the field artillery. Mr. Saunders is now connected with the chemical and metallurgical phases of the Tennessee company and frequently travels in service work on pig iron. He is commander of the American Legion post No. 35 in Ensley, Ala. Since its inception several years ago, he has been an ardent worker in the Birmingham district chapter of the A.F.A., serving on numerous committees and assisting in connection with the annual joint conference usually held in Birmingham early in the year.

♦ ♦ ♦

Dr. Cecil Henry Desch, who received this year's award of the Bessemer gold medal of the British Iron and Steel institute, long has been distinguished as a teacher of metallurgical chemistry. He was lecturer in that subject at the University of Glasgow and, subsequently, professor of metallurgy at the Royal Technical college and later, at the University of Sheffield where he succeeded the late Professor Arnold. His textbook, *Metallography*, has been for many years the classical publication on that subject in Great Britain. He is a leading authority on the chemistry of solids upon which he gave a series of lectures at Cornell university. In 1932 Dr. Desch was appointed to succeed the late Dr. Walter Rosenhain as superintendent of the metallurgical department, National Physical laboratory, Teddington. Since that time he has been in charge of researches which have for their object the production of high purity metals for the purpose of research. Under his leadership methods have been worked out for estimating the oxygen content of steels. Dr. Desch is a fellow of the Royal society, past president of the Faraday society, and president of the Institute of Metals.

♦ ♦ ♦

Kenneth H. Donaldson, acting head of the department of metallurgical engineering, Case School of Applied Science, Cleveland, has been appointed head of that department. He was born in Greenwich, Conn., and received his early schooling in New York. In 1912 he was graduated from Columbia university with the degree of engineer of mines, and immediately took a position with the Federal Lead Co. in Idaho. He held successive positions with the Anaconda Copper Co., Arkansas Valley Lead Co., Arkansas Copper Co., and Galconda Zinc Co. before going to Case as instructor in mining engineering in the fall of 1921.

In July, 1931, he obtained a leave of absence from Case to go to Russia as expert consultant on the concentration of iron ores for the Oglebay Norton Co., and traveled extensively inspecting mines in Siberia and other parts of the Soviet Union. Upon his return to the United States in March 1932, he was

(*Concluded on page* 40)

FOUND

in the

MODERN FOUNDRY...

10,000 pound locomotive cylinder, one of a pair produced from Nickel Cast Iron. For its properties, see chart below.

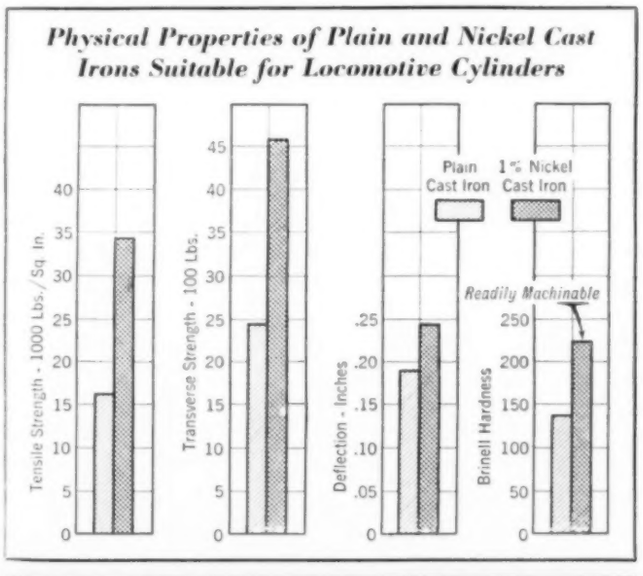
...a *New Method* to test

BIG JOBS

The Results of the New Method

(Tests Made in 4" x 18" Bars)

Physical Properties of Plain and Nickel Cast Irons Suitable for Locomotive Cylinders



NICKEL CAST IRON

● When a foundry recently cast two 10,000 pound locomotive cylinders like the one above, they discovered how to compare *accurately* the difference in properties between plain cast iron and a cast iron alloyed with 1% Nickel.

These large castings cool slowly. To approximate this rate of cooling, tests were made not in bars 1.20" or 1.50" dia., as ordinarily, but in test bars 4" dia. x 18" long.

It's no news to you that a small addition of Nickel gives a more uniform grain structure, with greater resistance to wear and shock. But to see *just how great* are the differences, look at chart at the left.

The new test bars illustrated clearly that these improvements of Nickel are even greater in large castings than in small. In a 1.50" test bar, the increase in tensile strength of Nickel Cast Iron over plain cast iron was 50%: but in the 4" bar, the gain was 100%!

• • •

These cylinders offer one striking example of the way the modern foundry is enlarging its scope, by constantly studying the results of new and improved alloys. Nickel increases effectiveness here, as in many other jobs. Consultation on your casting problems involving the use of Nickel is invited.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N.Y.

(*Concluded from page 38*)

invited by the department of State, Washington, to make a report to the government on the possibilities of trade with Russia. He has acted as a consultant for silver properties in Mexico, for gold properties in Canada and in 1925 and 1926 conducted an investigation on manganese deposits in the United States. In 1937 Mr. Donaldson was promoted to professor of mineral industry at the Case school and in February 1938 was appointed acting head of the department of metallurgical engineering. Professor Donaldson is a member of the American Society for Metals, Cleveland Engineering society, and is secretary of the Cleveland section of the American Institute Mining and Metallurgical Engineers.

♦ ♦ ♦

HARRY H. GREEN has retired as superintendent, Albion Malleable Iron Co., Albion, Mich., after 37 years of active service.

♦ ♦ ♦

DON D. MUNGEN, formerly associated with the Bass Foundry & Machine Co., Fort Wayne, Ind., and recently of the Colvin Interests, Chicago, has returned to the Bass foundry as vice president.

♦ ♦ ♦

L. STROCKSTROM has been advanced from president to chairman of the board, American Stove Co., St. Louis. His son Arthur, previously secretary and vice president, has been made president.

♦ ♦ ♦

V. P. RUMELY has been named Chicago works manager of Crane Co., Chicago. He formerly was affiliated with Hudson Motor Car Co., Detroit, and is past chairman of the Detroit section, Society of Automotive Engineers.

♦ ♦ ♦

J. N. GOODIER formerly of the Ontario Research foundation, has been named acting professor of mechanics, Sibley school of mechanical engineering, Cornell university, Ithaca, N. Y.

♦ ♦ ♦

WALTER K. DOW, plant superintendent, Alexander Milburn Co., Baltimore, Md., has been elected vice president of the firm. Before becoming associated with the Milburn company, Mr. Dow was identified with the DeVilbiss Co., Toledo, O., for 10 years.

♦ ♦ ♦

DR. ROBERT F. MEHL, head of the department of metallurgy and director of the Metals research laboratory, Carnegie Institute of Technology, Pittsburgh, was awarded the honorary degree of doctor of science by Franklin and Marshall college, Lancaster, Pa., at the annual commencement exercises.

♦ ♦ ♦

C. P. WHITEHEAD, manager of sales, has been elected vice president in charge of sales, General Steel Castings Corp., Eddystone, Pa. E. G. HALLQUIST, chief mechanical engineer, has been named vice president in charge of engineering.

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HARRY W. HOLT, vice president and sales manager, Bohn Aluminum & Brass Corp., Detroit, has resigned as an active executive of that firm. He continues as a director. Mr. Holt has been with the Bohn corporation since its formation in 1918, having served in both production and sales executive capacities.

♦ ♦ ♦

H. V. BEASLEY, for the past three years attached to the New York office of the International Nickel Co. Inc., New York, has been appointed director of that firm's new field office recently established in the Grant building, Pittsburgh, according to A. J. Wadhams, vice president and manager of development and research division.

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EUGENE C. SMITH, treasurer, Quality Aluminum Castings Co., Muskegon, Mich., has been elected president of the Clark Sanding Machine Co., also of Muskegon. He will continue to devote his chief attention to the former concern while C. A. O'CONNOR, sales manager of the latter company also will take over the duties of general manager.

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WILLIAM P. WOODSIDE, vice president, Climax Molybdenum Co., Detroit, has been nominated for president, American Society for Metals, to succeed DR. GEORGE B. WATERHOUSE, professor of metallurgy, Massachusetts Institute of Technology, Cambridge, Mass. Mr. Woodside is present vice president and had previously served as trustee and treasurer of the American Society for Metals.

♦ ♦ ♦

B. J. HERRON has been placed in charge of a new sales and service branch at 6200 East Slauson avenue, Los Angeles, recently opened by Independent Pneumatic Tool Co., Chicago. Mr. Herron has been with the company for the past 18 years, first as a salesman in Pittsburgh then for the past 12 years as general western representative.

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S. C. DU TOT, formerly district manager at Chicago for the Electro Metallurgical Sales Corp., New York, has been appointed district sales manager at Pittsburgh, with headquarters in the Oliver building.

W. E. REMMERS, of the Chicago office, Carbide building, will succeed Mr. DU TOT. Mr. Remmers also has been elected chairman of the Chicago chapter of the American Society for Metals.

♦ ♦ ♦

FLOYD A. BEATTY has resigned as senior vice president, in charge of plant operations, Lewis Foundry & Machine Co., a division of Blaw-Knox Co., Pittsburgh. Mr. Beatty became associated with the Lewis organization in 1925, and served successively as chief engineer, operating vice president and vice president in charge of engineering and machinery sales. He is a member of the Association of Iron and Steel Engineers, and American Iron and Steel institute.

♦ ♦ ♦

DEAN H. T. HEALD has been elected president of Armour Institute of Technology, Chicago. Dean Heald became connected with Armour institute in 1927 as assistant professor in civil engineering. From 1931 to 1933 he was associate professor of civil engineering and assistant dean of the institute and the following year served as dean of freshmen. In 1934 he was made professor of civil engineering and dean of the institute. In October, 1937, he was elected acting president upon the resignation of Dr. Willard T. Hotchkiss.

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M. P. FERGUSON, formerly vice president, Eclipse Machine Co., Elmira, N. Y., has been named vice president and general manager, Bendix Products Corp., South Bend, Ind. VICTOR W. KLIESRATH, former vice president in charge of engineering and general manager, Bendix Products Corp., will go to New York to direct activities of a new marine development division of Bendix Aviation Corp., of which he is vice president and a director. JOHN P. MAHONEY, vice president of manufacturing, has been made vice president in charge of industrial relations, Bendix Products Corp.

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A. C. HOWARD, for six years assistant general manager of the Beloit, Wis., plant of Fairbanks, Morse & Co., Chicago, has been appointed general manager of that plant. That position formerly was held by A. E. ASHCRAFT, vice president in charge of manufacturing, in addition to his executive control of all Fairbanks Morse factories in the United States and Canada. Mr. Howard's association with the company began 22 years ago when he was employed as an inspector at the Canadian Fairbanks Morse Co. Ltd., Toronto. He subsequently served as general manager of other Fairbanks Morse factories both in the United States and Canada.

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IN the foundries of the automobile industry, Penolyn Core Oil has taken first place by such a wide margin—used by over 80% in and around Detroit—that its superiority must be conceded. These manufacturers are influenced only by performance. They want speed and economy of operation.

Penolyn gives them these results . . . and does it consistently. Economy comes not only from greater workability, binding more sand, minimizing gases, complete decomposition for clean-out. It's the uniformity of results that puts Penolyn on top. Penolyn Core Oil permits standardization of foundry practice that speeds operations, cuts rejects, produces castings of smoother finish and greater strength.

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Syracuse

THE Syracuse Foundrymen's association held its regular meeting on June 14, with an attendance of 91. C. W. Thompson, New Jersey Silica Sand Co., Millville, N. J., showed a motion picture of his firm's sand bank operations. That was followed by an extremely interesting talk on "Sand Control and Sand Testing" by N. J. Dunbeck, Eastern Clay Products Co., Eifort, O.

In his talk, Mr. Dunbeck covered such phases as general description of sand testing and equipment; application of tests; relation of tests to casting defects; recommendations of sand properties for various classes of work, and a general discussion. Earl E. Woodliff, Harry W. Dietert Co., of Detroit, then demonstrated the use of his firm's sand testing equipment. Samples of molding sands submitted by those attending the meeting were tested. The tests supplied data for a lively discussion which followed.—*H. H. Judson.*

St. Louis

THE annual business meeting of the St. Louis chapter of the A. F. A. was held May 12. The following report of the nominating committee was presented and adopted by a unanimous vote of the organization: Chairman, J. O. Klein, Southern Malleable Iron Co.; vice chairman, L. E. Everett, Key Co., East St. Louis, Ill.; secretary-treasurer, John W. Kelin, Federated Metals division, American Smelting & Refining Co.

Chairman Klein announced the appointment of the following committee chairmen: Membership, R. I. Stifel, Hickman-Williams & Co.; entertainment, R. K. Durkan, Warren Coke & Coal Co., program, Webb L. Kammerer, Midvale Mining & Mfg. Co.; finance, J. W. Kelin, Federated Metals Division, American Smelting & Refining Co.; apprentice training, C. R. Culling, Carondelet Foundry Co.

Upon acceptance of the report of the nominating committee, George Mitsch voiced the sentiment of the chapter in expressing appreciation to George S. Haley for the very capable administration that was given the chapter affairs during the past year. Mr. Mitsch outlined the progress which has been made. Also of interest was the announcement that six new members had been received to the chapter.

Roy Jacobson then introduced Vaughan Reid, City Pattern Works, Detroit, who spoke on "Casting and Pattern Design". Mr. Reid's topic was presented in a most interesting manner and resulted in much general round-table discussion following the prepared talk.

P. E. Rentschler, president, Hamilton Foundry & Machine Co., Hamilton, O., was principal speaker at the April 14 meeting of the St. Louis chapter. Mr. Rentschler's subject was of general interest, being "Foundry Cost". The subject matter was presented in an interesting and detailed manner, outlining the cost system that has been applied to the Hamilton Foundry & Machine Co.—*John W. Kelin, secretary.*

Twin City

THE following officers of the Twin City Foundrymen's association were elected at a regular meeting held Monday, May 23 at the Minnesota union, University of Minnesota, Minneapolis: President, H. H. Blasjo, Minneapolis Electric Steel Castings Co., Minneapolis; vice president, Fred Kaim, Union Brass & Metal Mfg. Co., St. Paul; secretary-treasurer, O. W. Potter, University of Minnesota. The executive committee is as follows: Chairman, S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, Jack Bryant, Northern Foundry Co., Minneapolis, E. C. Madsen, Anderson Foundry Co., Bayport, Minn., Stuart Cameron, Valley Iron Works, St. Paul, E. H. Ryan, St. Paul Brass Foundry Co., St. Paul, George I. Ashton, St. Paul Foundry Co., St. Paul.

W. F. Piper, Beardsley & Piper Co., Chicago, presented interesting motion pictures entitled "Foundries Around the World."—*O. W. Potter, secretary.*

Southern California

APPROXIMATELY 100 members and guests attended the regular monthly meeting of the Southern California chapter of the A. F. A., held at the Clark Hotel, Los Angeles, April 28. Interesting talks were presented by Dr. Donald S. Clark, California Institute of Technology, Pasadena, Calif., and Silas R. Kimberly, metallurgist, Los Angeles Steel Casting Co.

Dr. Clark discussed the iron-carbon diagram while Mr. Kimberly outlined the manufacture of acid-electric steel castings. Following each talk the speakers led a lively discussion from the floor which brought out a number of interesting points.—*M. S. Robb, chairman publicity committee.*

Pittsburgh

AN EXCELLENT turnout was on hand at the regular May meeting of the Pittsburgh Foundrymen's association to hear a paper on the Randupson method of molding by Marshall Post, newly elected president of the American Foundrymen's association. Approximately 125 members and guests were on hand for the dinner and about 160 heard Mr. Post discuss the practices used at the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., of which he is vice-president and works manager.

As an additional feature, J. S.

(*Continued on page* 45)

(*Continued from page 42*)

Coxey, vice-president, Industrial Silica Corp., Youngstown, O., and a member of the Pittsburgh Foundrymen's association presented a motion picture entitled "Romance of Sand."

Officers nominated by committee at the April meeting were elected. These are O. Nadolny, Duquesne Pattern & Bronze Co., president; J. H. Johnston, Westinghouse Electric & Mfg. Co., vice-president; C. H. Paul, Mackintosh-Hemphill Co., secretary-treasurer.—*R. L. Hartford.*

Birmingham

THE following officers were elected at the regular meeting of the Birmingham district chapter of the A.F.A. held at the Tutwiler hotel, Birmingham, June 3: Chairman, C. B. Saunders, Tennessee Coal, Iron & Railroad Co., vice chairman, R. C. Harrell, Stockham Pipe Fittings Co.; secretary-treasurer, W. O. McMahon, Sloss-Sheffield Steel & Iron Co.; directors for one year, J. M. Franklin, Central Foundry Co., Holt, Ala., Frank Hamilton, Alabama Pipe Co., Gadsden, Ala., W. L. Roueche Sr., McWane Cast Iron Pipe Co.; directors for 2 years, J. E. Reynolds, U. S. Pipe & Foundry Co., Bessemer, Ala., Lester N. Shannon, Stockham Pipe Fittings Co.; directors for 3 years, R. R. Deas Jr., American Cast Iron Pipe Co., W. E. Curran, Republic Steel Corp.

Chairman R. R. Deas reported on the fine showing made by the Birmingham chapter at the convention in Cleveland and gave a brief resume of the chapter's activities for the past year. He reported an increase from 168 to 225 membership for the year. T. H. Benners Jr., chairman of the membership committee, introduced two new members.

Lester N. Shannon, director of the American Foundrymen's association, gave a brief outline of the recent meeting of the board of directors held in Cleveland. He also outlined some of the highlights of the plans of the A.F.A. which include closer relationship with the chapters of the organization. Secretary-treasurer R. C. Harrell presented a report showing the chapter finances in good condition.

W. O. McMahon, program chairman, introduced C. H. Morken, metallurgist, Corondelet Foundry Co., St. Louis, who spoke on "High Test Iron." The iron discussed was melted in the cold blast cupola at a temperature of 2800 to 2875 degrees Fahr. Two 1½-ton electric furnaces were used for refining the metal. Mr. Morken discussed the affects of various alloys such as nickel, vanadium, molybdenum, chromium etc. and illustrated the discussion with lantern slides of graphs, tables and micrographs. He gave the impression that the proper procedure for producing high test cast iron was to make the necessary mixture in the cupola or furnace for the particular service to which the casting would be subjected when in the field. He stated that castings with tensile strength of 65,000 pounds per square inch, which were machinable and had the necessary toughness were produced by that method without the use of alloys. However, structure of the metal made it necessary to heat treat that casting to relieve the stress and strain and to make it machine readily.

At the regular meeting held April 15, Frank W. Pedrotty, American Foundry Equipment Co., Mishawaka, presented an interesting talk on airless blast cleaning equipment. With the aid of a film, he presented information on fundamental problems of cleaning castings and offered practical solutions to many cleaning questions which confront foundrymen.—*R. C. Harrell, vice president*

New England

ABOUT 40 members and guests of the New England Foundrymen's association met at the Engineers Club, Boston, Wednesday, June 8 to witness the showing of the film "Steel" produced by the United States Steel Corp.

This is a technicolor film which has been shown in numerous sections of the country and has aroused considerable enthusiasm. It portrays the process of manufacturing steel from the mine to the finished product and in addition to being extremely interesting and instructive, provides a wonderful demonstration of color photography.—*M. A. Hosmer.*

Metropolitan

TOPIC for discussion at the regular meeting of the Metropolitan Chapter of the A. F. A. held at the Essex House, Newark, N. J. April 18, was "Steel Castings." John Howe Hall, consulting metallurgist, was the speaker of the evening and H. J. French, International Nickel Co., New York, acted as technical chairman.

Mr. Hall traced the history of the steel foundry from the early days of plain carbon castings to the present time. The first alloy steel put to use was Hadfield's manganese steel. It was used wherever toughness and wearability were required. Intermediate manganese steels followed and at about the same time the benefits derived by water quenching and drawing steel castings were discovered and put into use. Previous to that time plain annealing was the only heat treatment given to steel castings. Next came the introduction of low alloy structural steels, using nickel, molybdenum and chromium and combinations of these three elements. The speaker was of the opinion that of the maze of low alloy cast steels being used at present only five or six compositions will survive.

The steel foundryman has been faced with the competition of welding, but it has become apparent that castings will never be replaced by welded assemblies, said Mr. Hall. Steel castings are at present being used as parts of welded assemblies and it is through this channel that the foundryman will gain by welding. Further, the economic advantage of repairing defective castings by welding is of course recognized. While the advent of radiography in the foundry was dismaying to some, said Mr. Hall, it will prove one of the blessings of the industry.

Regarding the melting of steel, the speaker pointed out that the crucible process, which was first used, was replaced by the converter by reason of economy. In recent years the open hearth and electric furnaces have, to a large extent, taken the place of the converter. Now, however, since processes have been developed to remove the detrimental sulphur from melted cast iron, Mr. Hall anticipates a return to the use of the converter.

Discussing "Alloyed Cast Iron", V. A. Crosby, metallurgist, Climax Molybdenum Co., Detroit told members of the Metropolitan New York-New Jersey chapter at the May meeting that approximately 40 per cent of the iron castings now produced contained low alloy and more than 5 per cent high alloy.

Illustrating his remarks with lantern slides, Mr. Crosby discussed the effects of phosphorus on physical properties and described at some length the properties of the constituents of cast iron, emphasizing the strengthening effect of silicon in ferrite. The speaker illustrated the graphitizing value of alloying elements and traced the graphitizing and stabilizing effect of various elements on the carbide.

He presented a summary of the structural effects produced by various alloying elements, and spoke particularly of the effect of the common alloying elements on strength and hardness. Discussing the effect of the cooling rate, he said both graphitic and ferritic

structures undergo a change. He discussed the effect of 0.60 per cent molybdenum when added to a fairly high carbon iron and presented a table showing chemical analyses, physical properties, superheating and other data obtained from test run on three different irons, which indicated that processing has more effect than any alloy in producing strength.

Don J. Reese, International Nickel Co., Bayonne, N. J. and chairman of the chapter, presided. It was the last meeting of the season, with the next regular session scheduled for October.

Northeastern Ohio

AT THE regular monthly meeting of the Northeastern Ohio Chapter of the A.F.A. held May 26, five prizes—three firsts, one second and one third—out of a total of 12 awarded annually by the American Foundrymen's association in a nation wide patternmaking and molding contest for apprentices, were presented to young men from the Cleveland Trade school. C. E. Hoyt, executive vice president of the association presented the certificates accompanied by checks and warmly congratulated the boys on their proficiency. At a later stage in the program he referred to the origin of the fund which made these prizes and other marks of recognition possible and expressed the hope that at a later day some of the boys would qualify for the gold medals awarded year by year to men who had contributed in an outstanding manner to the progress of the foundry industry.

First prize in the nonferrous group was awarded Joseph Wyban, Art-in Bronze Co.; first in steel to Richard Reynolds and second in steel to John Palivoda, both employed by the West Steel Casting Co.; first in gray iron to Chester Marzec, Cleveland Trade School, and third prize to Jerry Halek, Johnston & Jennings Co.

In addition to James Goldie, foundry instructor and Frank Cech, instructor in patternmaking, Cleveland Trade School, the board of education for the city of Cleveland was represented by Charles H. Lake, superintendent of schools; John E. Fintz, director of special schools; and D. C. Courtright, principal of Cleveland Trade school.

Officers and directors of the Northeastern Chapter A.F.A., for the coming year were announced and include: Chairman Leroy P. Robinson, Werner G. Smith Co.; vice chairman, Charles Seelbach, Forest City Foundries Co.; secretary John H. Tressler, Hickman, Williams & Co.; treasurer, Russell F. Lincoln, Osborn Mfg. Co.; director for 1 year Fred A. Stewart, National Malleable & Steel Castings Co.; directors for 3 years, Bertram G. Parker, Youngstown Foundry & Machine Co., Youngstown, O.; Marcel Reymann, Atlantic Foundry Co., Akron, O.; S. P. Schloss, Superior Foundry Co., Cleveland.

Illustrated by a profusion of slides Russell F. Lincoln, Osborn Mfg. Co., Cleveland talked interestingly for an hour on the early development, gradual evolution and present status of the molding machine. He prefaced his remarks with brief reference to a lack of authentic data on where, how and by whom the first mechanical device was employed to pack sand in a mold. Vague tradition and rumor mention instances of crude types of hand squeezer machines in use here and there 60 or 70 years ago. However, so far as American foundries are concerned the first machines developed and sold on a commercial basis were the product of Mumford and Lewis in the East and Henry Pridmore in Chicago. In the early machines the sand was rammed by hand and the function of the machine was confined to rolling the mold and drawing the pattern.

The speaker presented slides showing the manner in which sand flows in the mold under pressure induced either by impact on the bottom or from a squeeze on the top. Under certain conditions a machine for performing either of the operations is satisfactory, while in others a combination of both is necessary. Running comment on each type of a great number of machines as they appeared on the screen covered mechanical features, method of operation, capacity and particular application to the production of a great variety of molds. Mr. Lincoln concluded his lecture with description of the construction, function, capacity and method of operating the core blowing machine in which sand from a magazine is forced under air pressure into the corebox.—*Pat Dwyer.*

Students in foundry and patternmaking at the Cleveland Trade School were guests of the Northeastern Ohio chapter

Detroit

THE June meeting of the Detroit chapter of the A. F. A. was held at the Clinton Valley Country club, Thursday, June 16. The afternoon was devoted to golf and was followed by a dinner in the evening. The following officers were elected for the coming year: Chairman, Ira F. Cheney, Griffin Wheel Co.; vice chairman, Harry W. Dietert, Harry W. Dietert Co.; secretary, Harry J. Deutsch, Aluminum Co. of America; treasurer, William W. Bowring, Frederic B. Stevens Inc.; directors, R. B. Crawford, Atlas Foundry Co., J. H. Crawley, Pontiac Motor Co., Pontiac, J. D. Stoddard, Detroit Testing Laboratory, D. J. Meloche, American Radiator Co., Glenn Coley, Detroit Edison Co., and L. G. Korte, Atlas Foundry Co.—*Harry J. Deutsch, secretary.*

Milwaukee

MILWAUKEE chapter of the A. F. A. held its regular meeting at the Schroeder hotel, Milwaukee on May 6 with Walter Gerlinger, Walter Gerlinger Inc., presiding. R. M. Jacobs, Standard Brass Works, chairman elect announced committee appointments for the coming year and requested the various chairmen to have their committees organized and functioning by July 1. Approximately 75 members and guests were present to hear an interesting and informative discussion on cast camshafts and crankshafts by Fred J. Walls, International Nickel Co., Detroit. Mr. Walls pointed out that the old conception of cast iron being an unreliable, weak, brittle material has been changed by the co-ordinated efforts of engineers, metallurgists and founders, with the result that we now have a versatile material possessing virtues in designs where dependability and durability are primary requisites.

Mr. Walls stated that factors

(*Concluded on page* 48)

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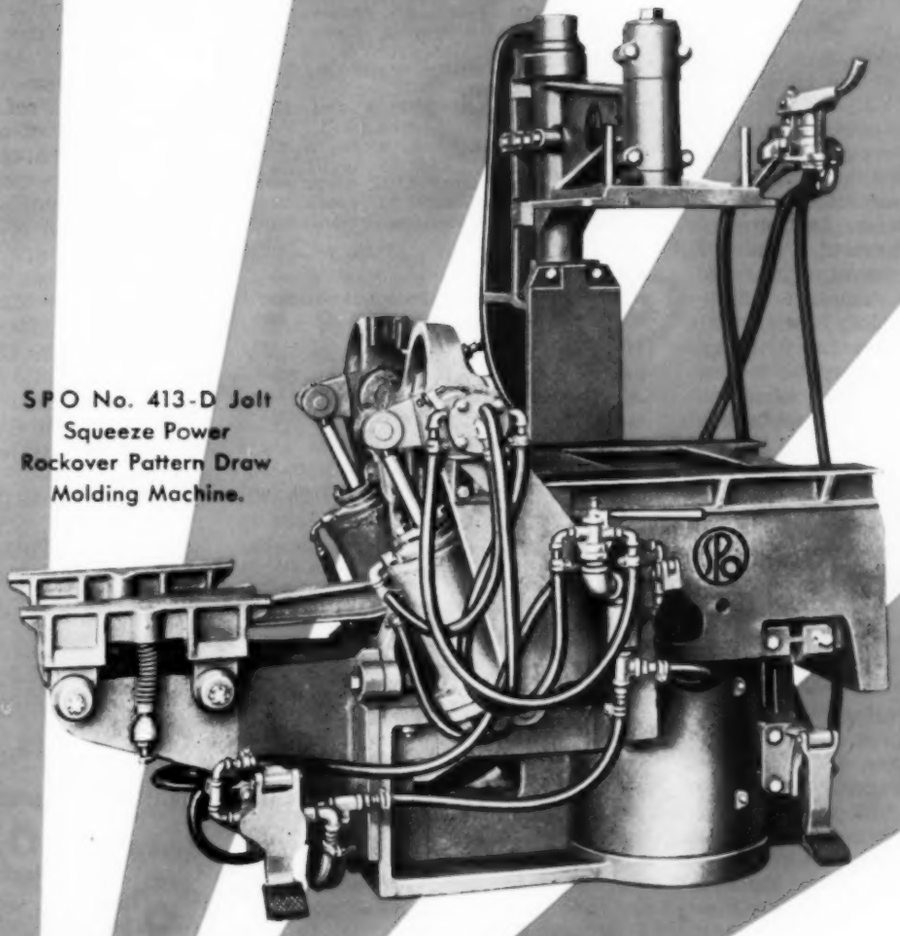

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(*Concluded from page* 46)

which justified the substitution of cast materials for forged materials in crankshafts and camshafts were economy, engineering design and material characteristics, and explained them. He listed the physical properties essential in cast camshafts and crankshafts as rigidity, wear resistance, torsional strength, fatigue strength, and damping capacity giving detailed information on each. He then presented information on compositions of irons which are being used successfully, and concluded his remarks by stating that with several years of successful service in the background, it is proved that by proper foundry control, reliable castings are a certainty.—*W. J. MacNeill, secretary.*

New Jersey

NEW JERSEY Foundrymen's association held its regular monthly meeting at the Downtown club, Newark, N. J., on May 27 with over 100 members and guests in attendance. President William P. Laytham presided and Vice President G. W. Hannay acted as technical chairman. James D. Coltman, foundry superintendent, Bullard Co., Bridgeport, Conn., spoke on "A Machine Tool Foundry." Some of the interesting points brought out in his talk were that his firm operates cupolas which are 60 inches, 40 inches, and 28 inches in inside diameter. The smallest cupola has an inside windbox of special design which is employed for special irons or experiments. Small iron charges are employed in the cupolas as indicated by a 1200 pound charge in the 40-inch cupola. The bed is 60 inches deep, and the cupola has a high stack of 18 feet. Forehearths are used on the two larger cupolas, and purite is employed to reduce the sulphur content to 0.08 per cent.

After experimenting with high steel scrap mixtures with a low total carbon content, the firm has standardized on mixtures containing 35 per cent and 10 per cent steel scrap. Various alloying agents are employed as the case requires. Mr. Coltman stated that the Bullard company has used hydraulic cleaning with good results. Cleaning time on one large casting was reduced from 27 hours to 3½ hours. Good results have been obtained from an automatically controlled drying oven which has cut coke consumption 25 per cent, and also from a sand muller which handles 1000 pounds of sand in 26 seconds. On many jobs all core molds are used, and it was found that they require less skill, obtain higher production, and lower loss.—*John L. Carter, secretary.*

Plan Rolla Regional Conference

Second foundry conference of the St. Louis chapter of the A. F. A., the Missouri School of Mines and the American Foundrymen's association, will be held at Rolla, Mo., Oct. 7 and 8. Advance interest indicates that a large group of foundrymen will be in attendance at all sessions. It is anticipated that a considerable group of interested workers from the Kansas City extension, a group of the St. Louis chapter, will be present.

A tentative program for the two-day meeting is as follows:

FRIDAY, OCT. 7

8:00- 9:00 a.m.—Registration.

9:30-12:00 a.m.—Cupola Practice.
Chairman: George W. Mitsch, American Car & Fdry. Co., St. Louis.
Speakers: M. J. Gregory, Caterpillar Tractor Co., Peoria, Ill. "Mechanical Charging with Cupola Control as Practiced at Caterpillar Tractor Co." A. O. Nilles, Griffin Wheel Co., Kansas City, Kans.

9:30-12:00 a.m.—Nonferrous and Malleable.
Chairman: J. O. Klein, Southern Malleable Iron Co., East St. Louis, Ill.
Nonferrous Speaker: J. W. Kelin, Federated Metals Corp., St. Louis, "Selection and Application of Nonferrous Alloys."
Malleable Speakers: Leon Wise, Chairman, research and development committee, Malleable Founders' society. Hyman Bornstein, Deere & Co., Moline, Ill., "Short Cycle Anneal."

12:45 p.m.—Luncheon (Long Hotel).
Address by District Chapter Chairman.
Speaker: J. O. Johnson, American Optical Co., St. Louis, "Safety in Foundries."

2:30-4:30 p.m.—Joint Assembly.
Address of Welcome: William R. Chedsey, director, Missouri School of Mines.
Sands and Refractories.
Chairman: L. C. Farquhar, American Steel Foundries, East St. Louis, Ill.
Sands Speakers: H. W. Dietert, Harry W. Dietert Co., Detroit, "Testing and Control of Molding Sands." Horace Deane, Deere & Co., Moline, Ill., "Molding Sand Problems in the Foundry."
Refractories Speakers: M. C. Booze, Chas. Taylor Sons Co. C. M. Dodd, professor, Missouri School of Mines, "Refractories from Missouri Clays."

6:30 p.m.—Dinner (Pierce Pennant Hotel).
Chairman: George S. Haley, Century Foundry, St. Louis.
Speaker: L. P. Robinson, Werner G. Smith Co., Cleveland.

SATURDAY, OCT. 8

9:00-12:00 a.m.—Gray Iron and Metallography.
Chairman: C. R. Culling, Carondelet Foundry Co., St. Louis, and president, Gray Iron Founders' society.
Speakers: S. R. B. Cook, professor, Missouri School of Mines, "Limitations of the Spectograph."

9:00-12:00 a.m.—Steel.
Chairman: W. Carter Bliss, Scullin Steel Co., St. Louis.
Speakers: Lee Everett, Key Co., East St. Louis, Ill., "Manufacture of Steel Castings for High Pressure, High Temperature Service."
Joseph D. Walsh, Scullin Steel Co., St. Louis, "Blow Holes in Steel Castings."

Saturday afternoon there will be a football game at the Rolla School of Mines stadium. Rolla vs. Chillicothe Business college; also golf for those who wish to play.

To Hold Conference At Purdue

Chicago Chapter of the A. F. A. will hold its first regional conference Oct. 27, 28 and 29 at Purdue university, Lafayette, Ind., under the joint sponsorship of the chapter and the university. The chapter has appointed the following committee to co-operate with the university in program arrangements: Chairman, Harold W. Johnson, Greenlee Foundry Co., Chicago; L. H. Rudesill, Griffin Wheel Co., Chicago; A. W. Gregg, Whiting Corp., Harvey, Ill.; J. D. Burlie, Western Electric Co., Chicago.

This committee is co-operating with a committee of the faculty of the university consisting of Prof. William Knapp, assistant dean of engineering; Prof. J. L. Bray, head of the school of chemical engineering; Prof. G. A. Young, head of the school of mechanical engineering; Prof. Ackerman of the department of metallurgy.

Personnel of Chicago chapter committees is as follows:

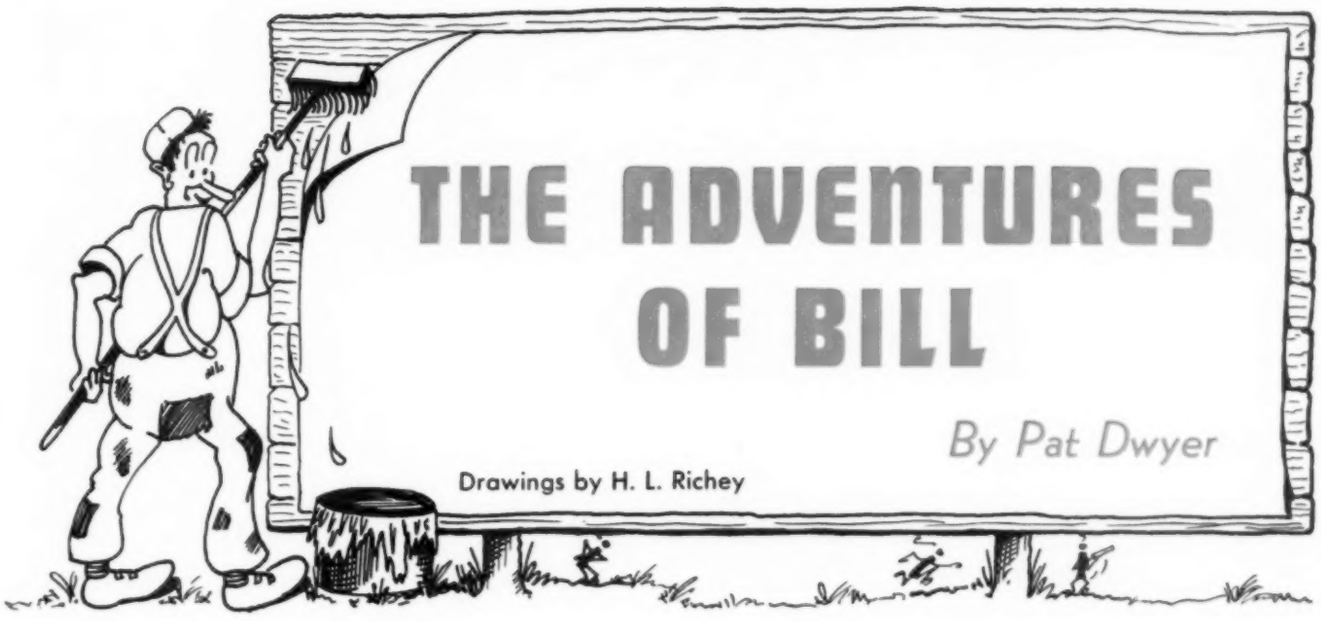
Gray Iron: Garnet P. Phillips, International Harvester Co., Chicago, chairman; H. K. Briggs, Western Foundry Co., Chicago; A. W. Weston, Chicago Hardware Foundry Co., North Chicago; Harold W. Johnson, Greenlee Foundry Co., Chicago.

Steel: A. W. Gregg, Whiting Corp., Harvey, Ill., chairman; C. E. Westover, Burnside Steel Foundry Co., Chicago; Bert Aamodt, National Malleable & Steel Castings Co., Chicago; W. H. Parker, American Steel Foundries, East Chicago, Ind.; James Thomson, Continental Roll & Steel Foundry Co., East Chicago, Ind.

Nonferrous: J. D. Burlie, Western Electric Co., Chicago, chairman; C. O. Thieme, H. Kramer & Co., Chicago; G. P. Halliwell, H. Kramer & Co., Chicago; A. C. Arbogast, Northern Indiana Brass Co., Elkhart, Ind.; H. J. Rowe, Aluminum Co. of America, Cleveland.

Malleable: L. H. Rudesill, Griffin Wheel Co., Chicago, chairman; B. C. Yearley, National Malleable & Steel Castings Co., Chicago; G. B. Stantial, Illinois Malleable Iron Co., Chicago; J. H. Lansing, Malleable Founders' society, Cleveland.

Considerable interest is expected to be aroused in foundries in Indiana and Illinois and the committee would welcome co-operation with foundries in these territories.



THE ADVENTURES OF BILL

By Pat Dwyer

Drawings by H. L. Richey

THE other night before daylight faded I sat on the veranda in easy neglige and finished reading Stevenson's immortal *Treasure Island*. Probably at various periods I have read the book a dozen times. Each time the charm of the sweetly flowing words was as fresh and entrancing as it was the first time I raced through the book with the keenest delight at one sitting and made the acquaintance of the redoubtable rogues Long John Silver, Black Dog and old blind Pew.

Smoking a quiet pipe in the peaceful dusk I wondered idly whether the master story teller had written chapter after chapter easily and spontaneously, or had experienced difficulty at times in finding just the proper combination of words. Where can you find a more tintilating paragraph than Silver's reference to his parrot Captain Flint:

"She's maybe 200 years old. They lives forever almost. But she have smelled powder she have. She've been to Madagascar and Malabar, Surinam and Providence and Portobello. She've picked up a deal of wicked oaths in her day, but she don't mean no harm no more than a babby. She'd do the same in a manner of speakin' " and here John pulled his forelock respectfully "before Chapling hisself." And then the parrot screamed "Pieces of eight, pieces of eight. Stand by to go about" and ended up with a stream of such violent deep sea profanity that little Jimmy Hawkins was practically petrified.

The utterly devil may care attitude of the gentlemen of fortune is so nicely and cleverly set forth in Silver's reference to the loss of his leg. "The same broadside I lost the leg, old Pew lost his dead lights. Ampitated I were by a master surgeon out of London College, Latin by the bucketful, but it didn't do him no good. Hanged with the rest, he were, and sun dried on the walls of Corso Castle."

Association of ideas prompted by the pirate sea chantey *Yo Ho Ho, and a Bottle of Rum* which bobs up here and there through the story, brought to mind another story of Stevenson's where the ruffling Jacobite, Alan Breck had great pleasure occasionally in risking his precious neck by whistling a sprig of music set to the forbidden: "O, Charlie is my darling, the young Chevalier!"

Inevitably this suggested the little ditty that bobs up here and there

Captain Flint knows all the answers

all through Kenneth Robert's charming romantic, rousing and patriotic *Rabble in Arms*, to my mind one of the great historical novels of all time, and the best of any dealing with the Revolutionary War. The ditty has no bearing on the outcome of the story, but it bubbles up like a clear little spring here and there as an ornamental feature: These were the happy golden years when I was in my prime. The lasses took delight in me, I was so neat and fine. I roamed around from fair to fair, likewise from town to town. And then I married me a wife and the world turned upside down! A lot of truth and philosophy packed in that little quatrain. At one time or another I have wondered what force is responsible for tossing odds and ends into the hopper when the mental engine is idling. They pop up without conscious effort and they fade away in the same manner. In this instance although the good old phonograph has been packed away in the attic since the radio invaded the premises, I found myself in imagination listening to Harry Lauder singing: I want to get wed in the summer time. I want to get wed in July.

I am a little hazy on a few words in the second line, but it seems to me they run: I want to get wed in the summer time when the weather is lovely and dry. Anyway, as Harry himself probably would say, you get the general drift of the thing. He wanted to get married and he did not want to be drowned or frozen on the presumably festive occasion. Also, although this point is not touched upon, it is only reasonable to assume that reduced and special ex-

cursion rates on all lines of travel reach the bottom of the curve in July. Harry showed a proper bridegroomly—if one may be pardoned for coining a special word for the occasion—a proper bridegroomly enthusiasm, but according to all contemporary accounts his enthusiasm never was fanned to a point that led him to throw bawbees through the window unnecessarily.

My quiet and peaceful meditation was interrupted at this point by Bill who ran his car into the driveway and as he said brought her up into the wind and dropped anchor. He hopped nimbly up the steps, burlesqued a salute to the quarter deck and announced gravely: "Come aboard Sir."

Not to be outdone in the exchange of civilities I politely inquired, "so, what?"

Sacred rites and duties of hospitality and all that jolly old kind of piffle if you follow me, or as they say ovah heah, if you get me. Rather silly, I mean, distorting the word *get* out of its original meaning and making it mean what it does not mean—Oh, well you finish it.

"Why the sourpuss attitude?" said Bill. "Is it the weather or maybe something you et? Or is this snarleyow condition a hangover from the convention? One thing you should be thankful for and that is that those who sit in high places on the A.F.A. band wagon do not decide to put on a show in July. Can you imagine sitting in a stuffy room for a couple of hours with all lights doused except a single beam playing on a screen while a voice from the darkness directs attention to a mass of lines on a chart that to the uninitiated looks like a half complete crow's nest. Reminds me of the comment I heard from one of the boys after sitting in on a highly technical session dealing with the carbon content of cast iron.

The good provider is not appreciated

"'High and wild,' says this brave lad, 'and entirely over my head. But what do I care? When my iron is a trifle off I dump a little dose of graphite in each ladle and my castings are O.K.'"

"If all the foundry troubles could be cured as easily as that," I said, "there would be no further need of holding any conventions. Unfortunately instead of gradually disappearing in the light of accumulated knowledge, the foundry problems seem to grow larger from year to year. Probably another exemplification of the old saying that the less a man knows, the less cause he has for worry. Where an old time foundryman blamed a bad casting on hard iron, wet coke or simply on the will of God and thereupon proceeded to make another one, the modern foundryman is confronted with element equilibriums, grain growth, dendrites, eutectoids, temperatures, occluded gas, effect of alloys singly or in collusion, shrinkage, expansion, temperamental customers, composition of the slag and the erratic behavior of perfectly good air on its journey from the tuyeres to the top of the stack. Any others?"

"Well," said Bill, "you might add a word or two about the difficulty of finding customers in need of castings for the past few years and maybe another word about the customers who expect the foundryman to make castings just for exercise. I have known men who developed severe head aches over these trifling features. However, I am happy to say we are all incurable optimists and look to the future with the greatest confidence. I was greatly encouraged by the cheerful and enthusiastic spirit shown by the crowds which thronged the recent convention and exhibition. One of the best I ever attended."

"The real old foundry atmosphere, eh?"

"Well, yes and no. Everything was there, sand, flasks, patterns, cores, chaplets, pig iron, sandblasts and blasts without sand, sand mixers, welders to touch up the spotty ones, snagging wheels, melting equipment and a wider variety of molding machines than an ordinary man could enumerate in a long summer day. Only one priceless ingredient missing."

"One missing? If any person should ride up in a horse and buggy—of course there is not much chance of any person riding up in a horse and buggy—but if such a person was to ask my opinion I should declare in a firm, manly voice—or what is left of it after competing with the clatter of the molding machines—that the show had everything ever seen in a foundry. In fact although I have been connected with foundries in one capacity or another practically all my life, I saw items in this latest show, I never had seen before."

"A fine detective you'd make! What about the smell?"

"What smell?"

"The foundry smell, my dear young fella. One of the most characteristic features of any casting shop. I have heard that mariners can dip fresh water from the ocean while still out of sight of land off the mouth of the Amazon. The foundry smell is not recognizable at a similar distance, but the wayfarer passing a foundry by day or night never has any illusions that he is in the vicinity of a conservatory or a perfume factory."

"I don't think much of your comparison. Many years close application of my nose to the grindstone

(*Continued on page* 84)

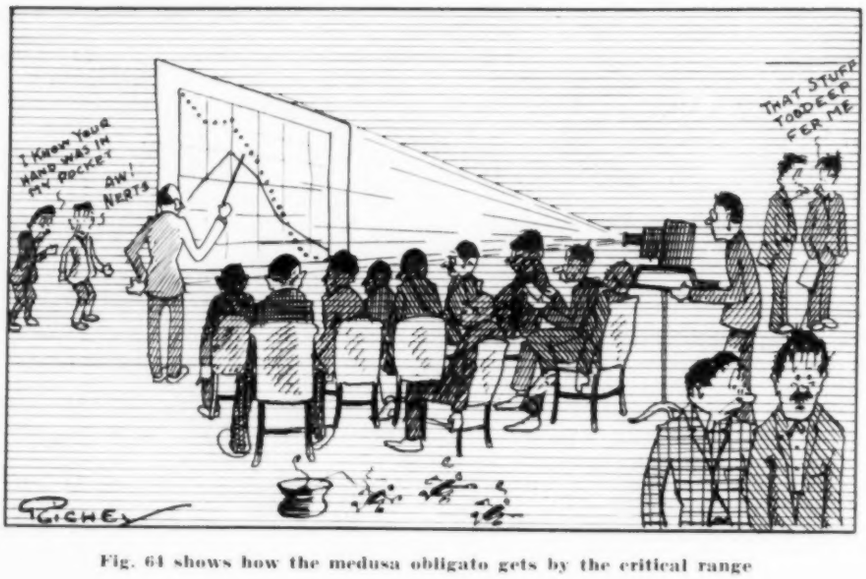


Fig. 61 shows how the medusa obligato gets by the critical range

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MORTON SALT COMPANY
CHICAGO, ILLINOIS

VIEWING Foundry Developments AT SHORT RANGE

ONE machine tool builder is using the flame hardening process to secure additional hardness and wear resistance on the v and flat ways of cast lathe beds. The hardened portion is approximately ⅛-inch deep with a brinell hardness number of 590 while the metal under the hardened portion is about 230. It is claimed that the hardened portions do not exhibit any tendency to crack or flake even under abuse.

* * *

One of the leading Chicago newspapers has replaced the old diamond shaped steel floor plates in its pressroom with cast iron plates having an abrasive surface. That not only makes the floor nonskid, but also helps to eliminate noise caused by moving material across the floor.

* * *

Heat treatment of aluminum bronzes essentially consists of quenching the alloy from any temperature from 1900 to 1060 degrees Fahr. in water or other suitable medium. In that range the alloy is within the beta or alpha-beta range. The beta phase is hard and strong but usually lacks ductility at room temperature. Precipitation of the alpha phase decreases hardness and strength, but increases ductility. Alloys may be heat treated further by tempering at some temperature below the quenching temperature, but above 1060 degrees Fahr.

* * *

A yellow brass for light castings and ornamental work not requiring strength or subjected to internal pressure contains about 69 per cent copper, 3 per cent lead, 27 per cent zinc, and not over 1.5 per cent tin. The alloy is handled in the foundry without difficulty and machines well. It has a tensile strength from 30,000 to 35,000 pounds per square inch, an elongation in 2 inches from 25 to 35 per cent, and a brinell hardness number from 40 to 50.

* * *

SCRATCH brush finish on aluminum alloy castings may be applied by first subjecting them to sandblasting, employing fine sand. Then a rotating wire brush is applied to the surface. Fineness of finish may be regulated by the size of the wires used in the brush. Wire wheels 10 inches in diameter made up of wires 0.005 to 0.015-inch in diameter, and operating at 450 to 600 revolutions per minute generally are satisfactory. Wires may be composed of brass, stainless steel, nickel or nickel-silver.

* * *

A composition for brake drums which is said to resist heat checks contains 2.10 per cent silicon; 0.30 per cent phosphorus; 0.70 per cent manganese; 0.50 per cent chromium; 0.15 per cent vanadium, and 3.40 per cent carbon.

* * *

Researches conducted by the Naval Research laboratory have disclosed the fact that the attack of an acid pickling solution for dissolving molding sand particles from steel castings is likely to cause some brittleness in steel, and affects the metal so that it will never recover all of its physical properties after any treatment applied to eliminate that deterioration.

* * *

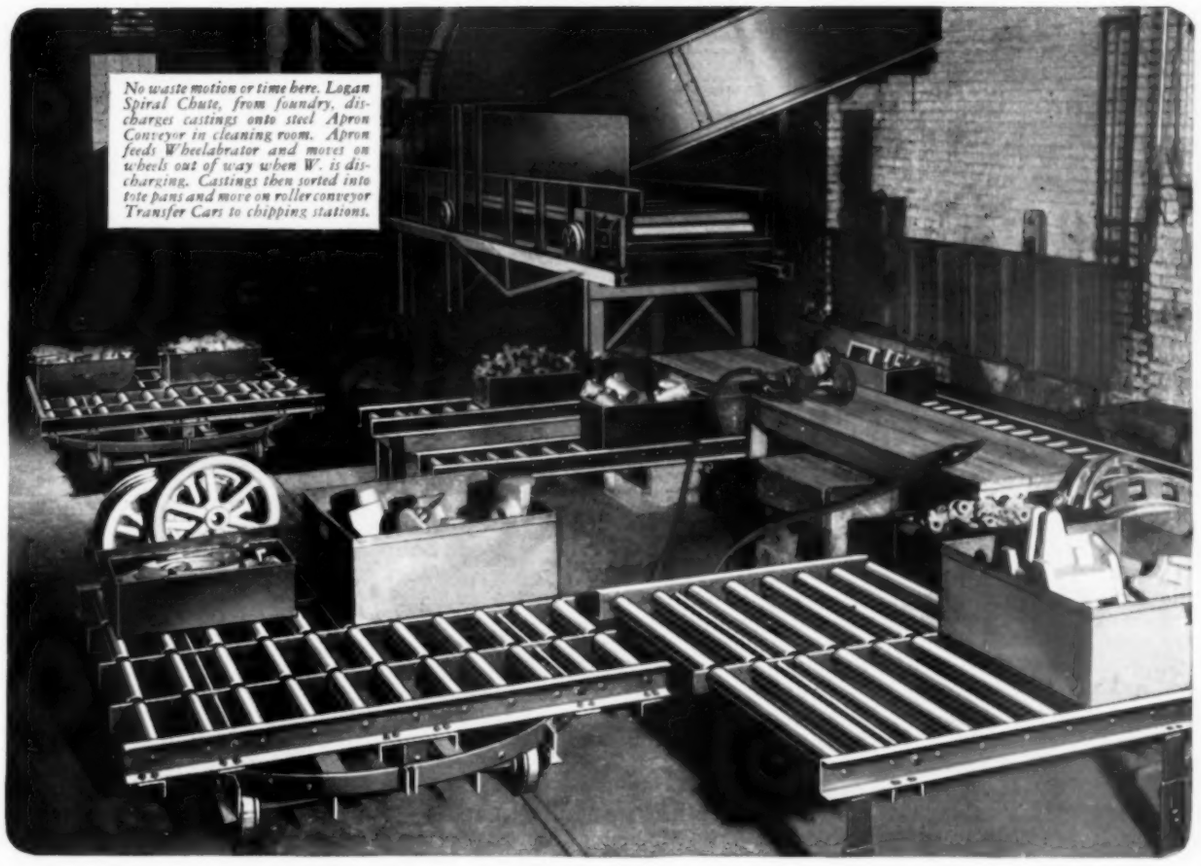
A foundry making special, high-manganese railroad crossovers had difficulty in obtaining solid metal under the points and flangeways where ribs and other supporting members were necessary to prevent fatigue cracking. X-ray examination of many designs revealed inherent weaknesses until ribs were eliminated, leaving the casting in the form of inverted channels underneath which change provided uniform section thickness throughout. To insure sufficient stiffness a separate flangeway supporting grid was welded into place later underneath the unit.

* * *

AS PART of a general clean-up and good housekeeping program a gray iron foundry has installed a home made device for collecting the slag wool formerly allowed to float promiscuously in the air while the cupola was in blast. A rectangular sheet steel funnel about 4 feet back of the cupola catches the sparks and wool discharged from the slag hole. A suction pipe attached to the funnel draws the wool for a distance of approximately 30 feet to a steel tank of the dust arrester type. Once a week the deposited wool is removed through a gate in the constricted bottom neck of this container.

* * *

Test coupons from a nickel-chromium-molybdenum steel dredge pump casing showed a tensile strength of 104,000 pounds per square inch; yield point of 72,500 pounds per square inch; elongation in 2 inches of 21 per cent, and a reduction in area of 39.7 per cent. The composition contained 1.86 per cent nickel, 0.86 per cent chromium, 0.25 per cent molybdenum, 0.85 per cent manganese, and 0.40 per cent carbon. Heat treatment consisted in heating slowly to 1750 to 1800 degrees Fahr.; holding; cooling slowly in furnace; reheating to 1550 to 1600 degrees Fahr.; holding; air cooling, and tempering at 1200 degrees Fahr.



No waste motion or time here. Logan Spiral Chute, from foundry, discharges castings onto steel Apron Conveyor in cleaning room. Apron feeds Wheelabrator and moves on wheels out of way when W. is discharging. Castings then sorted into tote pans and move on roller conveyor Transfer Cars to chipping stations.

Waste Elimination

★ ★ ★ COUNTS!

WASTE MOTION and *waste time* are prime enemies of low-cost production. And the foundry, large or small, that keeps these wastes to a minimum has a real *competitive* advantage. . . Hundreds of foundries use Logan Conveyors to do away with needless energy and time in handling flasks through molding, pouring, cooling and storage—and to handle castings and tote pans through cleaning, grinding and machining operations. . . Logan systems not only eliminate waste throughout these operations, but put a profitable flow into production from start to finish. Which means if you don't use conveyors you are probably doing it the hard way. The nearest Logan engineer is at your service, or write for Bulletin 15.

Logan Foundry Bearing is in protected position—set back from end of roll. All-steel seals.

LOGAN CO., Incorporated, Louisville, Ky.
580 Buchanan St.

MOVING IS 90% OF MAKING

Logan Conveyors

LOUISVILLE

Practice Problems Guide Convention Sessions

(*Continued from page* 31)

Milling Machine Co., Cincinnati, then brought up the subject of the temperature where the oil in cores is oxidized. Mr. Dierking replied that there was no critical temperature and by way of illustration pointed to an ordinary house-painting job, stating that the oil would oxidize thus causing the paint to dry at any practical temperautre. He said the same was true of oxidization of oil in drying cores.

Dr. Ries then read the report of the sand research committee, stressing what had been done in the past year and what the committee hoped to accomplish in the next 12 months, such as completing the "Handbook of Standard Tests," completing a pamphlet on the "Properties of Sand" and testing sands at high temperatures. Then with slides he showed a new testing furnace for sands and stated that electric heat had been discontinued and gas heat substituted. This unit can raise the temperature to 2600 degrees Fahr. in an hour. The sands are to be tested under different compressions at different temperatures. Dr. Ries expects to work out a number of interesting details which will be reported on later inasmuch as the lack of standard sand tests is detrimental to the scientific operation of the foundry industry.

"Modern Automotive Foundry Sand Practice," a paper presented by A. S. Nichols, Illinois Clay Products Co., gave the results of a number of tests conducted in seven different foundries. The author included detailed characteristics of synthetic sands, bonded with different clays to provide information concerning some sand properties not regularly included in control tests.

Malleable Shop Course

Two shop course meetings devoted to malleable practice problems were introduced at the Cleveland convention. At the Wednesday meeting D. I. Dobson, General Malleable Corp., Waukesha, Wis., introduced discussion leader, James H. Lansing, Malleable Founders' society, Cleveland, who briefly described developments in melting furnaces from hand-fired types to modern equipment. He added present trend was to replace oil with pulverized coal equipment because of lower fuel costs and because it is possible to melt a higher percentage of scrap iron.

Carl Joseph, Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich., pointed out electric melting furnaces give better control over carbon, silicon and manganese content and as there is no oxidation, melted metal can be held in the furnace. However, if carbon percentage is to be lowered the bath is diluted by adding baled sheet steel scrap.

Mr. Dobson inquired if 2.35 per cent was low carbon limit and reply was that at this percentage refractory attack was quite severe, producing a bad lining in an 8-hour day.

Duplexing appeared to have little advantage unless over 50-tons-per-day output is required and continuous metal is wanted. Mr. Joseph said that at production rates over that figure, duplexing was cheaper than other methods, especially when cheap charges are used such as baled sheet steel.

Mr. Lansing brought up subject of melting in the rotary type, powdered coal fired furnace and one user reported satisfactory results, melting 8 tons in 2½ hours. A checkup in one case showed 4 to 4¾ per cent total metal loss using 15 to 18 per cent cast iron borings. With this method rapid, small batch melts to make high silicon iron without graphitization are possible. Also, it is flexible so heats of different analysis can be made in rapid succession.

Speaking of annealing, Mr. Lansing briefly sketched types of furnaces. Subsequent discussion revealed that in radiant tube ovens cost of tubes depended largely upon type of iron. An oven handling 2.40 per cent carbon and 1 per cent silicon would have to be approximately three times as big as one handling same amount of high silicon iron to attain the same rate of production.

Mr. Joseph emphasized that amount of warpage depends upon packing and placement in oven. Automobile work must not be warped so all pieces are straightened, thus permitting minimum amount of overall machining. He also pointed out that life of radiant tubes depends upon rate of liberation of heat and maximum temperature. Thus a few tubes at the head end of heating zone get severe service while the remainder last a long time. Tubes in cooling zone last indefinitely.

Also it was pointed out that formation of scale does not depend upon size of sections of pieces but depends upon proper oven atmosphere.

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Metal Flows from Furnace to Ladle

THE background of the display of the Wisconsin Steel Co., a sales subsidiary of the International Harvester Co., showed molten metal flowing from the furnace to a ladle. A group of foundrymen and company representatives is shown in the booth. Left to right: E C. Reiman, Wisconsin Steel Co.; Prof. C. H. Casberg of the University of Illinois; William Linnell, metallurgist, Wisconsin Steel Co.; Robert E. Kennedy, technical secretary, American Foundrymen's association; J. Morgan Johnson, secretary, Quad-City Chapter A. F. A.; Otto F. Seidenbecker, general sales manager, Wisconsin Steel Co.; Alexander Weston, metallurgist, Chicago Hardware Foundry Co.; Garnett P. Phillips, metallurgist, International Harvester Co.; J. J. Fox, Wisconsin Steel Co.; Paul Nichols, assistant blast furnace superintendent, Wisconsin Steel Co.

(*Continued from page* 56)

Answering a query as to amount of distortion with increased temperature rises in continuous radiant tube annealing ovens, Mr. Joseph said that maximum temperature rises possible were not used because that necessitated increased time in holding zone so there was little net gain. A rate of 50 degrees per hour rise from 1500 degrees to holding heat is employed.

The second session was held Thursday afternoon with D. I. Dobson, as chairman. Ed Meyer, Chain Belt Co., Milwaukee, was shop practice discussion leader and his assistant was A. Van Lantschot, Iowa Malleable Iron Co., Fairfield, Iowa.

C. W. Weedfall, Saginaw Malleable Iron division, General Motors, Corp., Saginaw, Mich., presented an interesting paper "Design of Straightening Equipment for Malleable Iron Castings." Some of the important points discussed in the paper were causes of warp and deformity in malleable iron castings and the advantages gained by the use of straightening equipment to remove these defects, the effects of straightening and coining pressures on the structure of malleable iron, numerous formulas pertaining to correct pressures on various sections of castings, factors governing the design of straightening equipment, straightening fixtures, forming dies, squeeze dies and hammer dies. This paper was well illustrated with slides showing graphs and sectional views of various dies.

The importance of castings conforming to the customer's blueprints was stressed, it being pointed out that if the castings warped out of shape in the annealing operations they could not be expected to conform to gages or to fit into special jigs and fixtures necessary in subsequent machining operations.

It was shown how in the design of modern straightening dies all moving parts as far as possible were incorporated in the upper member. The object of this form of construction was to keep dirt away from the moving parts as far as possible. Hammer dies also were discussed. It was pointed out that they gave excellent results under some conditions but that squeeze dies were to be preferred in the majority of oprations.

Control of Molding and Core Sand Discussed

SAND was discussed at length at their shop course meeting. In the absence of the originally appointed discussion leader A. C. Arbogast, Northern Indiana Brass Co., Elkhart, Ind., practical problems in nonferrous control were discussed by H. W. Dietert, H. W. Dietert Co., Detroit at a meeting under the chairmanship of D. Frank O'Connor, Walworth Co., Boston. Following a brief general outline of the subject the speaker invited question and comment as he went along instead of waiting as usual until he had covered the subject. A question on suitable permeability brought the response that any sand with a permeability less than 10 is an invitation to trouble. Skilled molders can produce castings in low permeability sand by proper manipulation, but unfortunately the number of skilled molders rapidly is becoming less. Under ordinary conditions prudence suggests the use of a sand in which at least one of the hazards has been removed.

The speaker advocated a fairly open grain sand consistent with the finish desired on the casting. This precipitated a lively discussion and developed among other items that the sand supply men are keenly interested in the subject and practically without exception exercise close control over the sand and deliver according to close specifications. On the subject of fines and sand deterioration the speaker pointed out that sand in brass foundries is not exposed to the severe conditions prevailing in gray iron and steel foundries where the temperature of the metal is a great deal higher. For that reason the sand does not break down to the same extent and practically no reason exists for the removal of fines.

He instanced cases where sand heaps had been in continuous use for periods up to 10 years with no particular attention except the occasional addition of new sand to maintain the bond and to compensate for loss from sand adhering to castings. Exception of course was noted in the case of monel metal which is poured at a temperature of 2700 to 2800 degrees Fahr. Molds for that metal follow the practice in steel foundries. One speaker outlined the general practice where the permeability is at least 110 and where the molds for any castings over 15 pounds are skin dried. The meeting closed with a general discussion on why more castings are lost in wet weather than in seasons when the air is dry and warm.

The second sand shop practice course was held Wednesday morning with Donald Yost, Budd Wheel Co., Detroit, in the chair. The session was opened with a short talk by the discussion leader, R. E. Wilke, Deere Tractor Co., Waterloo, Iowa, on the practical problems of gray iron sand control with particular reference to the practices observed in his own plant. In the discussion a question was asked on whether there should be any difference in the clay contents of sand used for light and for heavy work. The reply was that in general there would be little difference. The essential factors to be controlled were permeability and moisture content of the molding sand.

Another question was asked on whether there was any method to show the effective amount of seacoal remaining in molding sand so as to know how much should be added from time to time. It was mentioned that the A.F.A. sand committee book on methods of sand analysis described a procedure in which direct combustion was employed, but that it might not indicate the desired information. One method suggested was to employ a cast iron wedge poured in the sand, and then observed how the sand peeled from the varying section thickness. Another suggestion was use of the microscope which would show the presence and amount of seacoal.

Mr. Wilke said that on heap sands that tests for permeability were run once a day which gave satisfactory control. However, he stated that in a continuous sand system that hourly tests for permeability, moisture and green strength were necessary to insure proper operating conditions. In reply to a question on determination of dry strength, he said that he did not perform it, but that in some plants it might be necessary since the dry strength might build up to a point where trouble would be encountered in removing the castings from the sand, casting strains, cracking, etc.

At the third and concluding sand shop course, P. Charles Fuerst, Falk Corp., Milwaukee, presided and H. L. Campbell, American Hoist & Derrick Co., St. Paul, led discussion on "Practical Problems of Core Room Sand Control." Mr. Campbell gave a brief talk outlining five chief points of sand shop practice.

First, he said that selection of sand is based on shape, distribution of grains and cleanliness, and that core sands are generally rounded, the aim being to use core sand with the largest possible grain size and still acquire the desired smoothness for the casting. Under the second point, selection of binders, Mr. Campbell

discussed linseed oil at some length and reminded foundrymen to bear in mind that a good supply of oxygen is indispensible for baking cores bonded with linseed oil. Third was the development of standard mixtures which the speaker said could be done by reliance on experiment and experience only when these studies are recorded and evaluated according to cost and performance.

Standardization of mixing procedure was the fourth point and Mr. Campbell claimed successful results were obtained only when order of adding materials and time allowed were controlled rigidly and records kept. Final point was standardization of baking. The speaker said that the kind of binder used dictates the time and method of baking. He cited three stages of baking cores bonded with linseed oil as follows: Heating up, evaporating and oxidation.

Slides were shown giving diagrams, use and results of machines for ramming up test cores, transverse core testing, testing for green bond strength of sand mixture and measuring permeability, clay content, amount of gas evolved and type and property of finish given by core sand mixtures. Mr. Campbell showed charts of analyses obtained by these methods and machines at various periods.

Elmer C. Zirzow, National Malleable & Steel Castings Co., Cleveland, brought out the inadequacy of test studies made up to the present time by citing the difference of opinion as to whether water should be mixed first or last. Mr. Zirzow also raised discussion about the hardness of sands and the use of quartz and cited the fact that certain sands increase in strength when burned at high temperature for reuse. Throughout his talk and in the discussion after, Mr. Campbell constantly referred to the necessity of keeping records and the value of specific studies as against haphazard judgment and rule of thumb methods.

Study Costs for Four Types of Castings

FOUNDRY costs session included four papers on melting costs. Sam Tour, Lucius Pitkin, Inc., New York, chairman, introduced A. E. Grover, cost consultant, Berea, O., who presented "Melting Costs in Nonferrous Foundries." Melted metal costs include cost of metal and melting expense, the latter being divided into cost of doing business, fixed overhead and operating overhead. Labor in unloading, sorting and storing as well as sampling and analysis expense is included. Shrinkage of not less than 5 per cent of metal value is included.

Items such as income tax, development expense, inoperative plant and unabsorbed overhead come out of apparent profits and are not figured as cost items. However, fixed overhead such as rent, depreciation, sales expense and advertising are prorated and included in costs in addition to operating-overhead items such as plant supervision, fuel and power, compensation insurance, and laboratory expense, also prorated to the melting melting department.

Mr. Grover pointed out that actual production costs for any month are not so important as to know how much they were above or below normal costs. In answer to why figure overhead costs in connection with melting department, it was brought out that this was necessary to estimate properly jobs and that if not included costs are fictitious and low yield castings are sold at a loss. In later discussion, it was pointed out that other methods used included overhead as a percentage addition, roughly 10 per cent, figured on end of estimated costs.

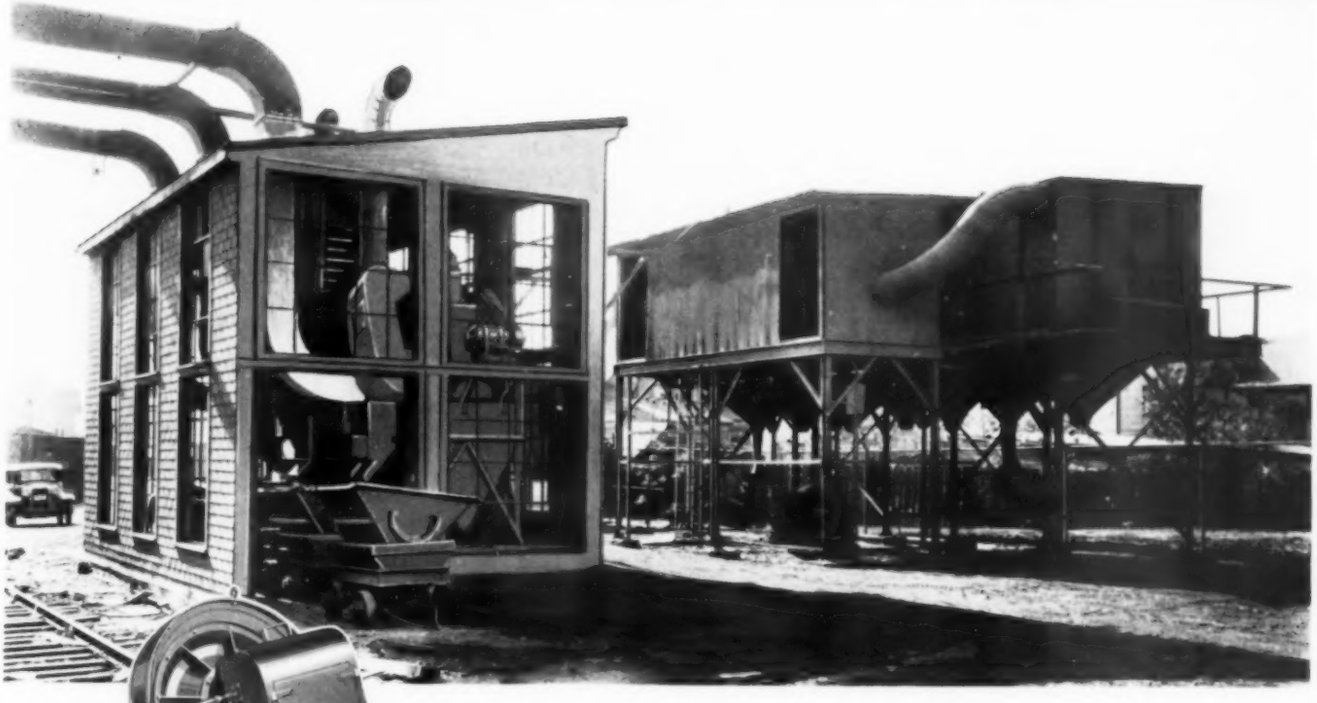
While melting cost per pound can be figured by dividing total costs by total pounds over a year's time, this only applies in foundries producing one metal. Where two or more metals are produced costs must be weighted as they usually are not the same for different metals.

Questioned as to whether interest on equipment investment was included in overhead, Mr. Grover called attention to fact that few authorities agree on this, no allowance being permitted on this item in figuring income tax. However, this is being included as a direct cost by some plants and figured in the profit account which appears to be approved by government authorities.

Second paper, "Calculating the Cost of Steel in Castings," by W. J. Corbett, Atlas Steel Casting Co., Buffalo, was presented by Raymond L. Collier, Steel Founders' society, Cleveland. Due to wide variation, importance of accurately determining yield was emphasized strongly. Yield here represented percentage of total metal charged into furnace that results in good castings. Some other cost men figure it as percen-

(*Continued on page 62*)

THREE No. 16 TYPE W ROTO-CLONES VENTILATE 22 TUMBLING MILLS . . . EXHAUST 20,000 C.F.M. . . . COLLECT 5 TONS OF DUST IN EIGHT HOURS!



THESE three No. 16 Type W Roto-Clones ventilate and collect the dust from 22 tumbling mills at a well known Midwestern foundry manufacturing automobile parts. They exhaust a total of 20,000 c. f. m., conveying the dust-laden air to a distance of 100 feet. Five (5) tons of wetted sand fines, collected by the Roto-Clones every 8 hours, are discharged continuously into dump cars by the automatic sludge ejectors. When certain types of castings are tumbled, a single No. 16 Roto-Clone will collect as much as 1,000 pounds of dust per hour.

This battery of Roto-Clones replaced the cloth collector shown in the background.

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TYPE W

ROTO-CLONE

WATER SPRAY DYNAMIC PRECIPITATOR

(*Continued from page* 60)
tage of total metal poured that results in good castings and take care of loss in furnace by other means.

Robert E. Belt, Malleable Founders' society, Cleveland, presented the third paper, "Melting Costs in Malleable Iron Foundries." Yield was recognized as the principal factor in giving truer metal costs. Sales, advertising and overhead expenses are included here by adding about 10 per cent to total price to get ultimate price of a job. Mr. Belt brought out that conversion costs in malleable iron practice include plant fixed charges and oxidation and metal loss whereas steel plant practice does not.

Fourth paper, "Gray Iron Melting Costs," prepared by Peter E. Rentschler and V. L. Diefenbacher, Hamilton Foundry & Machine Co., Hamilton, O., and William J. Grede and R. L. Lec, Liberty Foundry Co., Wauwatosa, Wis., and presented by Mr. Rentschler, Hamilton Foundry & Machine Co., pointed out that gray iron practice included all overhead items such as light, power, maintenance, advertising and selling, prorated and charged against the melting department.

Mr. Tour, at conclusion of the session, called attention to basic similarity of all four systems with possible exception of method of handling overhead items. He believed it possible to make a composite system, or uniform melting costs system, although there is no proposed A.F.A. cost system being advocated or contemplated. He stated that molding costs would probably be the subject of next year's cost session.

Cupola Melting Featured At Shop Course

IN KEEPING with past experience the cast iron shop practice courses proved exceptionally attractive. At the opening session presided over by Horace Deane, Deere & Co., Moline, Ill., a paper on cupola operation was presented by Donald J. Reese, International Nickel Co., Inc., Bayonne, N. J. In his introduction the author broadly defined the entire cupola melting process which, in his opinion, includes all the items involved from the purchase of the raw materials to the pouring of the metal into the molds. On the item of capital investment he pointed out that the average life of a cupola is 20 years. By dividing the cost of the cupola by the tonnage of iron melted in that period, it readily is apparent that the cost per ton is very small. In a typical figure taken for illustration the cost works out at 5 cents per ton.

One of the most important items listed in the operation of the cupola is the height of the coke bed. This was discussed from two standpoints. First the cost of the high bed in a large cupola, where a smaller bed and smaller diameter cupola might serve the needs of the foundry. Second and perhaps of more importance the author presented a detailed description of fuel burning rates, melting rates, normal operating conditions, wind pressure requirements, coke and metal charges. As a general rule he advocates the use of coke and metal in size to conform to the diameter of the cupola, coke one twelfth and iron no more than one third of the diameter of the cupola. Thus in a 36-inch diameter cupola the coke lumps should measure approximately 3 inches and the pieces of pig iron or scrap 12 inches.

Other features discussed included the procedure necessary to secure hot iron at the spout and the use of steel and limestone as component parts of the charge. He pointed out that steel has an affinity for carbon, therefore adjustments have to be made in the coke splits to correspond with the proportion of steel in charge. In this connection he also referred to tuyere performance, blowers, gages and metering devices. The concluding section of the paper dealt with control of moisture in the blast, preheated air and other factors connected with temperature of the iron at the spout and later.

Over 150 men attended the second session Tuesday afternoon directed by Leslie G. Korte, Atlas Foundry Co., Detroit. The session was opened with a brief talk by J. T. Mackenzie, American Cast Iron Pipe Co., Birmingham, Ala., on burnt iron. He pointed out that lack of attention to proper melting procedure led to the iron being oxidized or burnt as it is termed. Use of high blast pressures, low coke beds, improper size of coke for the particular dimensions of the cupola; rusty scrap, etc., were some of the causes mentioned.

Since erratic charging may lead to burnt iron, it was recommended that even layer charging of both iron and coke be followed with the coke split at least as thick as the greatest dimension of any of the charge iron. With a high blast pressure, better results are obtained by placing the iron on the outside and the coke in the center of the cupola. If by mistake the bed is made too low, it is advisable to use a low blast pressure until an extra split of coke can arrive at the melting zone, and then the blast may be increased to normal.

Oxidized or burnt iron appears hot in the spout of the cupola, but soon loses its fluidity or life. It also tends to throw off blue sparks; the greater the oxidation, the more

(*Continued on page* 65)

Two Win Foundry Exhibit Contest

THE large casting, which provided the center display of the booth of the Oiless Core Binder Co., was weighed officially at five o'clock on Thursday, May 19. *The following two contestants guessed the exact weight of* 1868 *pounds: Grace Quigg, Rosedale Foundry & Machine Co., Pittsburgh, and John Pearson, Strong Steel Foundry Co., Buffalo. The illustration shows the crowd at the weighing.*

(*Continued from page* 62)

sparks. Several stated that they observed sparks coming from their metal, but that they did not have any trouble. Reply was that undoubtedly the oxidation was not sufficient to affect the application. In bad cases of oxidation brown smoke appeared with the sparks. It was pointed out that zirconium and titanium deoxidizing agents would be employed to save iron which had been burnt, but it was better to see that burning did not occur.

The third cast iron shop course was held Wednesday afternoon with K. H. Priestly, Eaton-Erb Foundry Co., Vassar, Mich., presiding. Discussion of the meeting centered around a paper prepared by C. C. Brisbois and A. E. Cartwright, Robert Mitchell Co. Ltd., Montreal, on direct pouring of high test and alloyed cast iron. The paper was presented by Mr. Cartwright. Essentially the method described by the authors consists of pouring the castings through riser instead of the usual practice of employing sprues and risers.

Casting Shows Defect

W. J. Maton, Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., opened the discussion by showing a sectioned casting similar to a solid hub, flanged wheel about 8 inches in diameter, which contained a small hole or fissure in the center of the hub. He said that it was poured from a 2.25 per cent silicon, ordinary gray iron, according to methods described by the authors, and desired to know why it did not work out satisfactorily. It was pointed out that the direct pouring method tended in the particular casting involved, to form a casting that was twice the size of the original, and that the iron was then too soft, resulting in a coarse open structure, and the formation of kish in the center. Also the riser through which the metal was poured was too close to the casting, and hence caused excessively slow cooling.

It was suggested that a 1.75 per cent silicon iron with 3 per cent carbon would give good results. In reply to a question on composition of iron used by the authors, it was stated that it contained 1.75 per cent silicon, 3 per cent carbon, and 1 per cent nickel. In heavy casting some chromium was added to the mixture. Mr. Cartwright said that to prevent breakage of the riser into the casting when cleaning, small pads were placed at the junction. The latter gave increased metal section, and the riser broke off above the pads.

The subject of carbon pickup in the cupola was discussed from various angles at the concluding shop course session on cast iron under the chairmanship of Harry Rayner, Dodge Brothers Corp., Detroit with Garnet P. Phillips, International Harvester Co., Chicago as discussion leader. Exchange of opinion seemed to indicate a lack of unanimity in regard to the factors directly responsible for the carbon pickup, also for the variation in the amount of pickup under apparently similar conditions. Referring to the latter feature one speaker explained that all the coke from a given batch is not necessarily uniform in structure. Carbon pickup is greater from certain types of coke than from others, therefore constant check of the resulting iron is necessary to compensate for any changes. Foundrymen generally are familiar with the fact the addition of steel to the cupola charge affects the carbon content, first in the distribution of the carbon and secondly in the total amount absorbed from the coke. Change in the amount of steel added to the charge is adopted in some instances to equalize and regulate the anticipated carbon content of the metal charge.

Several members engaged in a discussion on the advantages or disadvantages of allowing the metal to soak in the cupola before starting the blower. It was admitted that in some instances the method presented an advantage because the metal was close to the melting point before the blast was applied, therefore the metal came down faster. However, if all air inlets are closed, this advantage is not apparent. One speaker claimed that no advantage accrues from allowing the charge to soak. In his practice the bed is burned through for a short distance above the tuyeres. Coke sufficient to raise the bed to the desired height then is added and the cupola is charged as high as the charging door. At this stage the blower is started immediately. He claimed that the carbon pickup is greater and more uniform from the fresh coke than it would be from coke that is partly consumed. A speaker claimed that to meet a certain specification of carbon content of 3.76 per cent he had to raise the coke bed to 56 inches above the tuyeres.

Apply Job Evaluation to Small Foundries

MENTIONING briefly the growing importance and use of job evaluation in the foundry industry, H. C. Robson, Continental Roll & Steel Foundry Co., East Chicago, Ind., introduced E. L. Roth, Motor Castings Co., Milwaukee, who presented a paper entitled "Job Evaluation for the Smaller Foundry." Mr. Roth said that, for finding a fair rate of pay and for establishing understanding with workmen, the validity of job evaluation is unquestioned. Considering the situation in 1937 when skilled workers were receiving a fairly uniform wage in different shops and the minimum rate in most shops in the same locality was consistently close, the speaker said there was, however, a large group of workers between the top and bottom wage scale who were receiving greatly divergent rates of pay for the same type of work. Mr. Roth cited the worth of job evaluation in this situation and also as a help to the industry as a whole in allocating properly wage expenditures and allowing foundrymen to continue to compete with makers of stampings, welded products, etc.

Mr. Roth set forth the method as comprising 41 classifications coming under five departments, namely: Molding, core, cleaning and shipping, melting and miscellaneous. He explained the use of 15 factors which are given a per cent value and then are multiplied by the weight given that particular job, and added up to yield the point value of the job. This point value is applied to a chart with a determining line from minimum to maximum wage rate which reveals the wage rate for that job. No originality for this method was claimed by Mr. Roth who said it was devised by Merrill R. Lott and published in 1926 in a book "Wage Scales and Job Evaluation."

Ralph H. Landes, Western Electric Co., Chicago, and director of study and research, Industrial Management society, Chicago, spoke briefly, and then gave an interesting demonstration of the occupational rating plan of the Industrial Management society. He said management must be able to demonstrate to workers why one job pays more than another and that the simplest way would be to list all classifications of jobs from the least to the most important. Another method cited was to study each job carefully and then catalog the individual job.

In contrast Mr. Landes set forth the Industrial Management society method of employing the four main classifications of skill, responsibility, working conditions and physical re-

quirements. These classifications are in turn broken down into 22 factors which are given as: Dexterity, precision, versatility, adaptation period, ingenuity, schooling, initiative, judgment, knowledge of equipment, methods and materials, responsibility for equipment, materials and safety of others, supervision received, discomfort, health and accident hazard, clothing spoilage, acuteness of senses, strength and endurance.

A schedule showing the range of point values for the 22 factors was distributed to those attending the session. W. L. Roueche, McWane Cast Iron Pipe Co., Birmingham, Ala., offered a description of a specific craneman's job from time to time as the group gave maximum and minimum evaluations which Chairman Robson noted on the blackboard. Completion of the sample evaluation yielded a figure which Mr. Roueche said was what an expert craneman would receive. C. E. Westover, Burnside Steel Co., Chicago, asked whether this was occupational or job evaluation and made a strong plea for foundrymen to try to establish consistent terms. Mr. Roth replied that, regardless of the terms used, the job itself and not the individual must be evaluated.

Mr. F. E. Reiners, York Ice Machinery Corp., York, Pa., pointed out the importance of job evaluation where molders and machinists are in the same plant and also where the same type of job occurs in more than one department. L. O. Taylor, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., elaborated on the possible use of a scale where an incentive plan is in force. Charles I. Ritchie, Gray Iron Founders' society, Cleveland, declared that company policy must decide whether the personnel or the occupation is to be graded. The difficulty of modifying the basic rate according to changes in general conditions was pointed out by G. S. Haley, Century Foundry, St. Louis. E. J. Metzger, Falcon Bronze Co., Youngstown, O., said one of the great difficulties in trying to give molders general classifications was the great variety of equipment in different foundries.

Study Effect of Service On Refractories

THE first paper at the refractories session on Monday evening was presented by C. K. Donoho, metallurgist, American Cast Iron Pipe Co., Birmingham, Ala,. and was entitled "Effect of Cupola Practice on Linings." J. A. Bowers, American Cast Iron Pipe Co. was chairman of the meeting.

Mr. Donoho reported findings of an investigation on effect of blast pressure, nature of charge, length of heat, and diameter of cupola on consumption of refractories in the melting zone. Tests were made by holding all other factors constant and varying only the one factor under consideration. Refractory consumption was determined by number brick required to patch melting zone after each heat. Figures were averages of 4 to 24 heats.

Testing various types of refractories indicated degree of attack was roughly proportional to porosity of brick. Effect of increased blast pressure was a linear increase in refractory consumption. Lower per cent silicon resulted in more attack, variation caused by silicon content increasing with higher blast pressures. Consumption was found not directly proportional to time, a 16-hour heat taking from 1.1 to 1.9 the amount of refractories consumed in an 8-hour heat. Smaller cupola necessitates lower blast pressure to reduce erosion caused by impact of air jets, but even with much lower pressures rate of consumption was higher for smaller cupolas. Basic factor believed responsible for refractory attack is amount of iron oxide present. Thus any factor that increases oxidation of metal increases refractory attack. This would explain why higher silicon content produced less attack since silicon oxides more readily than iron resulting in less iron oxide and thus less attack.

This was confirmed by C. E. Bales, Ironton Firebrick Co., Ironton, O., in subsequent discussion. He said that although known for some time, this was the first paper presenting data to show increased blast pressure cut out refractories faster. Possibly this effect could be accounted for by higher pressure increasing oxidation with greater attack resulting, he pointed out.

E. L. Graham, Acme Foundry & Machine Co., Coffeyville, Kans., inquired whether or not percentage of steel effected refractory consumption. Mr. Donoho replied that it changed consumption very little, most important being silicon content.

In a paper, "Refractories for Foundry Ladles", presented by C. E. Bales, Ironton Firebrick Co., three new types of refractories were discussed. Ladle pouring brick, half cylinders stuck in mud ladle lining, are useful in causing metal to pour without slag inclusions. However, these are not suitable for steel foundries due to high pouring temperatures with excessive erosion and tendency to freeze steel in cylinder.

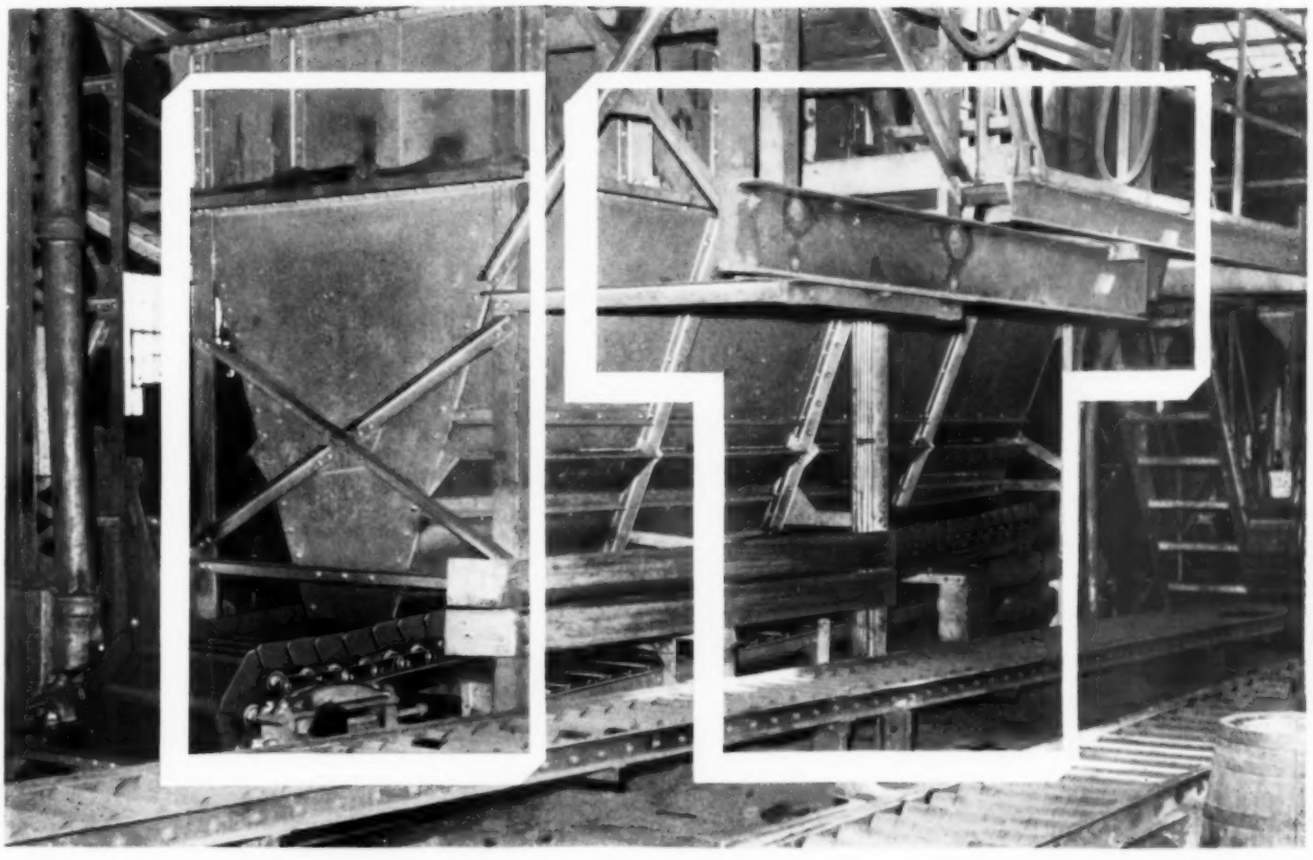
Another new refractory is ladle

(Continued on page 68)

Hold Annual Dinner at Cleveland

DURING the recent Cleveland convention and exhibition, the Cleveland Quarries Co., Cleveland, held its annual dinner for representatives and visitors. In the illustration from left to right, reading back and around the table: H. W. Seestedt, R. P. Haynes, M. J. Carpenter, E. T. Ripley, L. L. Seestedt, H. G. Leibold, F. G. Schultz, F. H. Busching, M. B. Giberson Jr., J. R. Wark, J. D. Sullivan, E. A. Burr, F. G. Metzger, E. N. Carpenter, F. A. Bauman, T. J. Hamlin, C. A. Wirtz, Mr. Briggs, F. H. McGee, L. M. Joy, W. A. O'Brien, P. J. May; second row against the wall, left to right, G. F. Slama, L. M. Spencer, J. R. Turner, H. D. Carson

HOW TO HANDLE



IF *IT* IS FOUNDRY SAND AND RISING COSTS

A gray iron foundry, which would be rated modern, found that it needed to be even more modern, if it were to hold its customers in a highly competitive branch of the molding industry.

A Rex Foundry Sand-Handling System was installed. Savings resulting were:

42% ..... Molding Cost
35% ..... Floor Space
11% ..... Cleaning Cost
2% ..... Metal

The value of the percentages of the first two items of saving is immediately apparent, but every foundryman knows that the latter two are also highly important and generally considered much more difficult to secure.

Incidentally, a long time test of the Special Rex Foundry Bucket in this system was recently completed with interesting results as to the possible added life for buckets:

It was found that the wear on the Z-Metal buckets was 25% less, and on the Z-Metal bucket's hardened lip was 75% less than that shown by the buckets previously used. Naturally, the savings in replacement and upkeep cost were appreciable.

A new book "How to Handle IT in the Foundry" shows Rex foundry systems in action in a variety of sizes and types of plants. It will be a real help to you in modernizing *your* plant. Use this coupon to get your free copy.

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REX FOUNDRY EQUIPMENT

CHAIN BELT COMPANY of Milwaukee

(*Continued from page 66*)

bottom tile, a flat circular disk now used in sizes from 1 to 4 inches thick and up to 30 inches in diameter. Bottom tile eliminates chipping and fitting bricks to make bottom and prevents loose joints developing with subsequent bottom dropouts. It makes a dry solid bottom and prevents boiling.

Third development is rammed linings, made by putting up firebrick or insulating brick against ladle shell, placing wood form inside and ramming space between with plastic material using an air hammer. Most suitable material contains a large percentage of free calcium clay instead of ground up brickbats; denser plastics seem best for this work. One user reported forty 50-ton heats with one rammed lining, patchwork being used on the last 10.

The English exchange paper, "Characteristics of the Silica Refractories Used in the Cupola", by W. J. Rees, University of Sheffield, Sheffield, England, was read by Elmer Carmody, Ada, Mich., vice-chairman of the session. Much plastic rammed material is used in England. Paper points out the eutectic where fusion point of plaster ramming material dips almost 100 degrees Cent. Better plastics avoid this point which occurs within the 96 to 84 per cent silicon range and 4 to 16 per cent fluorspar range. Good ram material, when heated to 1450 degrees Cent. was found to expand less than 1 per cent which offsets shrinkage if moisture content is below 7½ per cent.

Discusses Equipment for Handling Materials

MATERIALS handling featured a session held Thursday morning with E. W. Beach, Campbell Wyant & Cannon Foundry Co., Muskegon, Mich., chairman; and James Thompson, Continental Roll & Steel Foundry, East Chicago, Ind., vice chairman.

W. Carter Bliss, works manager, Scullin Steel Co., St. Louis, presented a paper on "Importance of Maintenance to Foundry Operations." Mr. Bliss stressed the fact that the modern foundry has outgrown the primitive sand and shovel days and that modern equipment is necessary to keep production costs at normal. Installation of such equipment has added a new phase to the problem in that this equipment, often of a complicated nature, must be maintained in working condition at all times to forestall expensive shutdowns.

Mr. Bliss pointed out that foundry equipment in a plant such as he represents must function 24 hours a day. He stressed the importance of carrying spare parts for various units and cited interesting facts about the maintenance of belts, sand mills, shakeout apparatus and core room handling equipment. He also stressed the importance of adequate annealing furnace insulation. He described an interesting blast cleaning method lately installed at the Scullen plant.

In the discussion which followed, H. L. McKinnon, C. O. Bartlett & Snow Co., Cleveland, pointed out that all conveying equipment should be sufficiently heavy to withstand a reasonable overload. On the subject of belt conveyor rolls, J. B. Silver, Palmer-Bee Co., Detroit, stated that the number should be sufficient but not excessive thereby reducing maintenance to a minimum. Mr. Bliss then drew attention to the importance of a sufficient number of shear pins in conveying mechanism whereby a stalled unit would shear the pin and avoid an expensive breakdown.

Mr. Silver then discussed "Conveyors in a Modern Foundry" in an informal way. He stated that the subject was not always fully understood as varying materials presented different problems. He described several types of conveyors for sand, castings, and molds. He pointed out that each foundry has its own peculiar problems which always must be considered in designing and installing conveying equipment, and that maintenance problems always should be considered in selecting any given type of equipment.

A. F. Anjeskey, Cleveland Crane & Engineering Co., Wickliffe, O., then read a paper "Handling Molds and Castings by Overhead Materials Handling Equipment in the Small Foundry." This paper was illustrated by slides and was most interesting. In producing a ton of castings he stated that it was necessary to handle from 25 to 100 tons of materials, hence the necessity of adequate handling equipment to keep production costs at normal. The slides were made from photographs taken under working conditions in a foundry using 14,000 patterns and producing castings weighing from 2 to 18 pounds.

In the discussion which followed a member asked if an adequate system for conveying metal could be used in a nonferrous foundry where several kinds of metal were handled. Mr. Anjeskey replied that conveyors in correct designs could be used and that it simply was a question of proper layout.

Win Prizes

The following foundry employes won prizes in connection with the safety contest conducted by W. W. Rose, executive vice president Gray Iron Founders society during the first quarter of 1938: 1, Michael Johnson, Farrel-Birmingham Co. Inc., Ansonia, Conn.; 2, Ed. Rosfelder, G. & C. Foundry Co., Sandusky, O.; 3, Oliver Fortin, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; 4, R. G. Holland, Gra-Iron Foundry Corp., Marshalltown, Iowa; 5, Ed. Rich, Decatur Casting Co., Decatur, Ind.; 6, O'Dell Poe, Forest City Foundries Co., Cleveland; 7, John Plante, Sessions Foundry Co., Bristol, Conn.; 8, Delbert Hough, LaPorte Foundry Co., LaPorte, Ind.; 9, Anthony Lewandowski, Enterprise Foundry Co., Rochester, N. Y.; 10, Homer Harris, G. H. & R. Foundry, Dayton, O.; 11, Albert Frazee, Hamilton Foundry & Machine Co., Hamilton, O.; 12, Ewald Ernst, Semi-Steel Casting Co., St. Louis; 13, Thomas F. Barry, Sessions Foundry Co., Bristol, Conn.; 14, Leo Stocki, Chain Belt Co., Milwaukee.

Plan Meetings

Porcelain Enamel institute will hold its eight annual meeting at Cleveland, Oct. 25 and 26. The third annual Porcelain Enamel institute forum will be held at the University of Illinois. Urbana, Ill., Oct. 12, 13 and 14. F. E. Hodek Jr., General Porcelain Enamel Mfg. Co. is chairman of the forum committee.

Among the recent exhibits opened to the public at the Franklin Institute, Philadelphia, is one showing the heating effect of induced high frequency currents. All parts of the equipment for generating the high frequency current are visibly arranged in a glass case, enabling one interested to trace the circuits and, as he pushes a button, to see just what happens during the heating cycle. This exhibit was a donation of the Ajax Electrothermic Corp., Trenton, N. J.

Design Is Important

(*Continued from page* 23)

inadequate understanding of foundry practice were cited as follows:

1—Possibility of failure of castings in service due to improper design, poorly proportioned sections, or abrupt changes in section resulting in shrinks. The possible failure of such parts might bring castings into general disrepute.

2—Increased costs by needless requirement of cores, bosses, recesses, or ribs.

3—Failure to take advantage of the foundryman's ability to cut costs. With proper explanation to the foundry of the requirements with respect to flatness, straightness, or freedom from fins, many shop operations may be eliminated—such as facing, straightening, or snagging.

Where special factors indicate the ultimate need or economy of an intricate design, malleable iron lends itself to casting in many diverse forms. Examples of applications of this facility to complex design are revealed in the accompanying illustrations of specific parts.

Simplify Manufacture of Parts

This facility may permit useful conversions with the elimination of many machining or assembly operations. Fig. 2 illustrates the simplification of part manufacture through elimination of assembly. The top two specimens represent a connecting rod, with the 1-piece malleable part replacing an assembly, saving 52 per cent in weight, and eliminating the drilling of 8 holes.

The lower brackets demonstrate a weight reduction of 39 per cent, and the saving of 26 punched holes as well as considerable assembly work. The other parts are different treatments of a hitch, with the malleable design on the left providing economy in part cost as well as improvements in service and appearance.

Figs. 1 and 4 show the finished part and casting of a theatrical curtain track carrier, recently introduced. A cold coined boss to the close limits of 0.003-inch permits accurate attachment of a ball bearing wheel shaft. An integrally cast swivel is the means of supporting the curtain.

Figs. 1 and 4 are examples of design application to provide serviceability in the agricultural field. The equipment is part of a rotary hoe. Clamped in each of the 5 grooves on the spider shown in Fig. 4 is a rolled spring steel *digger*, shown at the left in Fig. 1. The part which wears out and requires frequent replacement is the digger, due to contact with stones and hard earth. Under the original construction, removal of one digger required the dismantling of the machine and progressive removal of as many as 9 or 10 spider units.

The improved design employed 1 malleable iron spider, shown at the left in Fig. 4, and 5 supplementary castings as well as the steel diggers for each unit shown in Fig. 1. There was a reduction in weight, but of greater importance was the ease of digger replacement, which could be consummated by the removal of only one bolt and nut on the spider unit involved.

An outstanding application of the principle of integral joint casting to provide a special advantage in service is contained in a patented malleable iron chain link illustrated in Fig. 4. The link is cast in one solid piece, with the roller permanently in place over a solid bearing. During casting, the metal flows through the roller bore to create a solid unit link but is prevented from freezing to the roller by a sand and shellac film.

Design May Be Varied

The view at the left in Fig. 4 indicates the unicast construction. The bearing, it will be noted, is continuous and assumes part of the shearing load on the pin. Fig. 4 also shows at the right the cope and drag of one mold as well as the pattern and several castings of such links.

These illustrations have been cited to show the manner in which design may be varied to effect certain use objectives. The existence of this range of possibilities should not obscure, however, the economy which may be attained in many cases by adhering to the simplest in design.

While the price per pound of a casting is considered a measure of designer-foundry correlation, a more valuable criterion is the total cost of the finished part. In some cases, it is possible to eliminate certain operations, as has been shown, by redesign or reduction of stock. In other cases, the addition of finish allowance eliminates difficulties and results in a lower ultimate cost per part.

Ultimate determination of the best treatment in any given case is dependent on the extent of user-foundry co-ordination, and on the understanding which user and producer have of each other's objectives and needs. Effectiveness of this teamwork in the malleable industry is given special impetus by the work of the shop practice councils, and by the efforts of research and practice engineers retained by the Malleable Founders' society. Through the council meetings and by consultation with the engineers, member plants are helped to the solution of many foundry or design problems, and give their consumers the advantage of the industry's aggregate experience.

Some of the fundamental factors worthy of review in this consideration of design as it relates to the production of malleable iron castings, are discussed in the following paragraphs.

Casting sections should be as nearly uniform as possible, abrupt changes in section thickness being avoided. Where it is necessary to vary metal from light to heavy section, a gradual taper of the joint makes for greater economy in production and for greater strength. If this is not feasible, the design may permit ribs of sufficient thickness to facilitate feeding; such ribs may be placed on the light sections so as to connect with and feed into a heavy section or boss.

Heavy sections contract at a slower rate than lighter ones upon solidification in cooling, and expand more upon annealing. Unusual variations, therefore, necessitate special measures to prevent shrinks.

Where heavy sections such as bosses or lugs are located on the interior, it is desirable to have large sections of metal leading to the feeding source. The location and size of the ribs should be such that they can be fed or, if connecting light and heavy sections, they should be of such thickness that they can be used to feed metal through into the heavy parts.

Fillets as Large as Possible

A suitable place should be provided for attaching gates and feeders to heavy sections.

Fillets should be as large as possible and the use of re-entrant angles should be avoided. The reasons for rounded corners and large fillets may be summarized as: (a) Easier molding; (b) less scrap from shrinkage and cracks; (c) less danger of cutting away of sand by flowing iron.

Avoiding the use of dry sand cores when possible will eliminate core-making expense and produce cleaner castings. Ram-up cores are to be preferred to set cores.

Parting lines should be as near even as possible.

Designs should provide ample draft for easy molding.

Deep pockets and small recesses that complicate drawing the pattern or lifting the cope should be avoided.

Sufficient finish allowance is re-

quired when castings are to be machined, and the amount of such finish should be indicated. For small parts, from 1/32 to 1/16-inch is satisfactory, with larger parts requiring proportionately greater allowance.

The following factors are important in determining the needed finish allowance: (a) Size of casting; (b) whether a heavy-sectioned compact casting or a large light-sectioned one, the latter having greater tendency to warp; (c) whether quantities are large enough to justify the making of straightening dies; (d) the fact that many finishing operations on malleable castings can be performed in a coining press without need of machining or of a machining allowance; and (e) the further fact that many disk grinding operations are performed on malleable castings, for which operations only a small finish allowance is required.

Locating points should be held to one side of the parting to eliminate trouble in machining. When castings are to be machined, the blueprints sent to the patternmaker should show machine shop locating points. If these are not shown, the patternmaker may either not consider these points or may assume them to be other than those which will be used in machining the part.

Dimensions which have no finish allowance and are to be held to very close limits should be considered as the proper place from which to start development of the required tooling fixtures.

The benefit of these general rules, and of specific considerations which may apply to special cases, is assured the user or designer when his needs are adequately understood by the foundryman, and when the latter's co-operation is enlisted in the design of casting or part under consideration.

Bring the Shop to Customer's Door

A modern version of Mahomet and the mountain legend is shown in the accompanying illustrations, an attractive trailer converted into a traveling exhibition booth for the products of the Lake City Malleable Co., Cleveland. Many present, past and potential customers may have no opportunity to inspect the plant, equipment and product of the company, hence the decision of the company to bring a display to the doors of all who may be interested in the purchase of malleable iron castings. The decision was influenced partly by the interest shown in former displays of the product at fairs, conventions and other places where large numbers of men connected with various sections of the industrial field congregate. In many instances orders for castings were directly traceable to contacts of this kind.

The trailer built to order is attractively fitted on the inside and illuminated for the proper display of a wide range of castings in the rough and finished condition. For contrast several castings are shown beside others displaced on account of weight. Through redesign the malleable castings are shown to be lighter, stronger and in many instances more pleasing in appearance. Several contrasting types of pattern equipment are shown to illustrate the advantage of consulting the foundryman before the patterns are made or placed in production, since even slight alterations at times make considerable difference.

At first the trailer will be driven around Cleveland and neighboring territory. Gradually the scope of travel will be extended to cover all territory in which the company has representatives. Each man in turn will hook the trailer to his car and show the display to his present and potential customers. In conference with members of his staff, J. H. Redhead, president Lake City Malleable Co., claimed that business was not going to get any better if they simply sat around and grouched. An unusual effort might stir up demand in their particular line. The traveling trailer idea presented interesting possibilities. Under present business conditions it was felt that executives, purchasing agents and members of engineering staffs would have more time to view the exhibition, discuss individual problems and listen to the sales talk of the company's representative.

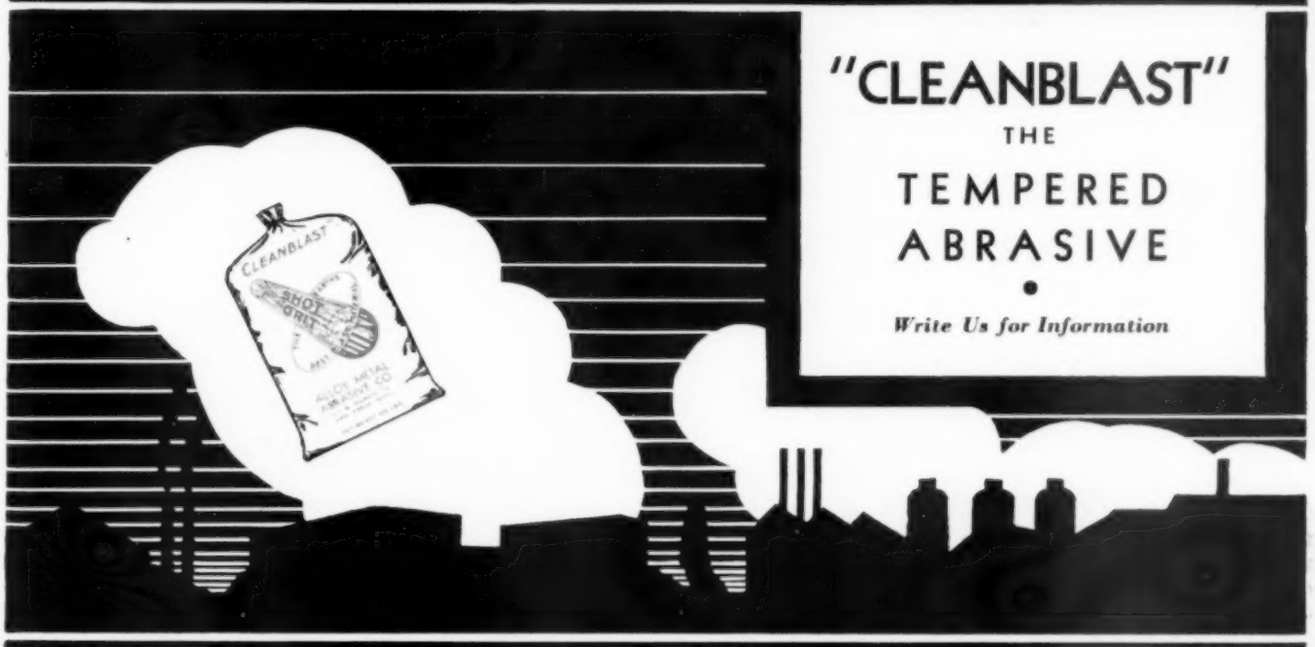
Exterior of trailer displays prominently the firm's name and type of product while the interior shows range of castings

Honor Veterans

Farrel-Birmingham Co., Inc., Ansonia, Conn., held its second annual service banquet on May 23. Guests of honor were 130 men who have been with the company for a quarter century or more. Nine who have served the organization for 50 years or over were seated at the head table.

John D. Martin, who had just completed 50 years service, received a gold watch and chain. Nelson W. Pickering, president, was toastmaster and Franklin Farrel Jr., chairman of the board, presented the awards. The chief speaker was Louis M. Ruthenburg, president, Servel Inc.

SHOT "CLEANBLAST" GRIT



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UNIFORM density, uniform distribution of bond and moisture, freedom from caking, flowability in the mold, absence of heating, high strength and permeability.

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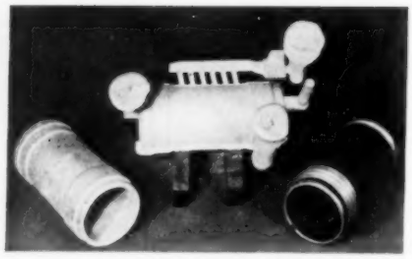

Fig. 31—Wet type cylinder liner which is heat treated shown in various stages

Practice Close Control

(*Concluded from page 27*)

iron over the past several years.

Since a number of different specifications on cast iron are required for various parts of tractors and road machinery, and many times castings conforming to all these different specifications are poured on the same day, one readily can see the complications that arise with a problem of this kind. To combat the situation, a great deal of experimenting has resulted in the development of two base irons. From these two base irons, various other types of cast iron are evolved, primarily by the addition of alloys at different stages of operation.

Fig. 31 shows another grade of iron made from the same base iron shown in Fig. 27. The only difference is the alloy content. This particular illustration shows a heat treated wet liner in various stages, from the time it leaves the mold up to the time it is completely machined and ready for the assembly of an engine. The difference is brought out in comparing Figs. 22 and 19. In crankshafts note the absence of chromium and the addition of a considerable amount of molybdenum.

A stack of piston rings entirely different from the conventional piston rings used in automotive practice is shown in Fig. 32. These rings are heat treated and are made of regular base iron used in the general run of castings. Alloy additions are shown in Fig. 23.

Attention is directed to the fact that for piston rings where a large percentage of alloy is added, hot iron is the most important factor. In this instance hot iron means iron with a temperature considerably above 2800 degrees Fahr.

Sufficient ferrosilicon is added to the metal in the ladle to raise the silicon content to at least 2.75 per cent. The ferrosilicon should be of a very low aluminum content. Experience shows that if the aluminum content of ferrosilicon is above 0.60 per cent there is a strong tendency for gas holes to form in light sectioned castings. For the ordinary type of casting, late addition of ferrosilicon, the commercial grade which runs as high as 1.5 per cent and higher does not seem to have any effect. For light, thin castings the aluminum content should not exceed 0.6 per cent.

Late addition of silicon, in this case, perhaps does not increase the physical properties as much as nickel and molybdenum, over the regular base. A general average of impact tests on base iron would show approximately 30 foot pounds, and the tensile strength would average 38,000 pounds per square inch.

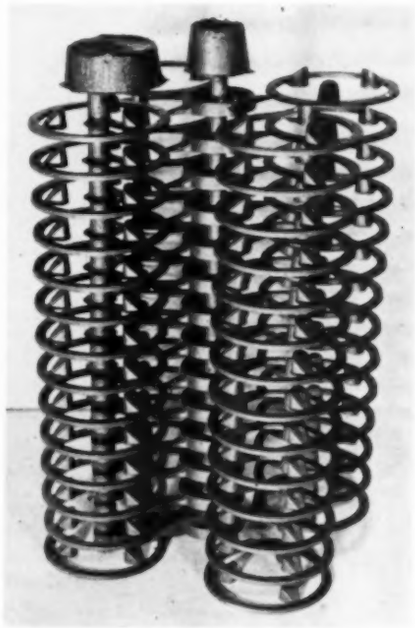

Fig. 32—Piston rings are cast in stacks

Table II

Test Bars with Chemical and Physical Analysis

Date	T. C	Mn	S	P	Si	Ni	Cr	Mo	Imp	Tensile	Brinell Center	Brinell End
9-14-37	3.25	0.73	0.086	0.136	2.19	1.67	0.10	0.74	68.0	56400	4.0	3.7
	3.27	0.75	0.076	0.130	2.04	1.75	0.09	0.90	96.2	56800	3.7	3.75
	3.25	0.75	0.083	0.128	2.02	1.20	0.10	0.63	65.2	56500	3.9	3.75
	3.25	0.75	0.067	0.128	2.07	1.98	0.11	0.89	93.2	56600	3.9	3.75
9-15-37	3.04	0.80	0.115	0.142	2.02	1.52	0.05	0.80	100.0	69100	3.6	3.7
	3.00	0.77	0.112	0.125	2.00	1.56	0.07	0.74	90.0	65750	3.6	3.65
	3.03	0.80	0.107	0.111	2.02	1.42	0.06	0.75	97.0	69100	3.7	3.6
	3.11	0.79	0.093	0.111	2.05	1.72	0.06	0.88	91.5	66350	3.7	3.6
9-16-37	3.05	0.73	0.106	0.178	2.05	1.44	0.05	0.84	84.0	55000	3.8	3.7
	3.00	0.73	0.099	0.132	2.09	1.25	0.04	0.71	91.0	62200	3.7	3.7
	3.00	0.72	0.088	0.132	2.07	1.40	0.06	0.75	84.5	55700	3.9	3.7
	3.00	0.68	0.085	0.125	2.08	1.35	0.06	0.57	53.7	56000	3.8	3.75
9-20-37	3.11	0.73	0.113	0.144	2.16	1.47	0.09	0.75	80.5	56800	3.7	3.8
	3.11	0.73	0.104	0.126	2.20	1.77	0.09	0.81	92.5	64000	3.9	3.6
	2.98	0.71	0.106	0.121	2.21	1.33	0.09	0.75	87.5	62700	3.8	3.6
	3.00	0.72	0.102	0.112	2.30	1.99	0.09	1.00	91.2	65800	3.6	3.65
9-21-37	3.11	0.77	0.111	0.149	2.16	1.47	0.05	0.86	86.0	60500	3.8	3.7
	3.14	0.79	0.105	0.149	2.23	1.33	0.05	0.65	91.0	60250	3.9	3.7
	3.05	0.76	0.101	0.140	2.25	1.53	0.05	0.75	103.0	61250	4.0	3.75
	3.08	0.74	0.106	0.130	2.16	1.38	0.06	0.69	94.2	67550	3.8	3.8
9-22-37	3.16	0.67	0.110	0.132	2.07	1.46	0.03	0.80	83.0	63000	3.7	3.65
	3.22	0.68	0.094	0.149	2.30	1.73	0.03	0.90	94.5	57700	3.8	3.7
9-23-37	3.00	0.67	0.107	0.206	2.33	1.42	0.03	0.79	49.0	57900	3.7	3.7
	2.95	0.66	0.102	0.207	2.35	1.67	0.04	0.85	64.0	64050	3.9	3.6
	2.95	0.69	0.090	0.204	2.30	1.90	0.03	0.72	61.0	59100	3.6	3.55
	2.85	0.71	0.091	0.191	2.25	1.25	0.03	0.87	74.2	57500	3.7	3.55
								Averages	83.3	60908		

Melting Nonferrous Metals

(*Concluded from page* 28)

should take place as promptly as possible after the fuel has left the burner so that even at the burner orifice there is a minimum of fuel yet to reach complete combustion. Complete combustion accomplishes two objectives. It gives maximum temperature, and, therefore, maximum speed of operation of the furnace. It reduces the danger of gassing the metal. Obviously, since the time for heat transference from the flame to metal is short, a maximum temperature difference between furnace atmosphere and metal to be heated is most desirable.

Maximum efficiency of combustion must at all times be maintained so that the metal remains in the furnace the shortest possible length of time and is poured immediately when it reaches the desired temperature. To keep a charge in the furnace awaiting the completion of further molds is a dangerous practice and frequently has been the cause of many defective castings. Combustion conditions may vary without the furnace operator being entirely aware of it unless careful vigilance is maintained.

Remove Slag From Furnace

The furnaces should at all times be kept clean of slags by the regular practice of cleaning them after each day's operation. It is an excellent practice to liquefy the slags that remain in the furnace after the day's operation by turning on the flame for a sufficient length of time, and then rotating the furnace into a position whereby these slags as they become fluid will run out of the furnace mouth.

We have mentioned previously the desirability of the proper alignment of the orifices through which the flame enters into the burner. However, we have not emphasized the importance of keeping the orifices clean and free from slag. Proper size also should be maintained so as to permit free flow of flame in the proper direction without establishing eddy currents which might effect the proper mixing of air with fuel to produce the best combustion conditions that are so essential.

With proper attention to, and the proper installment of the right kind of lining for a given type of metal to be melted, it should last a very long time. Some foundries estimate lining life in terms of months or years of life, which is quite misleading, particularly in times when the furnaces are not necessarily operating every day.

It is much better practice to record the number of pounds of metal a furnace has produced with a given lining. The author likes to speak of this as the number of pounds over a given lining. It will be easy to calculate the cost of lining per pound of metal melted and then from a record showing the amount and cost of repairs, a total of the expenses for furnace lining maintenance easily is established in terms of the metal produced by the furnace. A comparison of such a cost per pound of the different types of linings available will establish promptly the kind of lining to be preferred for a given product, or a given foundry, or both.

Lining Absorbs Metal

It is a recognized fact that a new lining always absorbs some of the metal melted upon it and finally reaches a point where it is saturated with all of the metal it will absorb. Thereafter absorption ceases except as it gives off some of the metal that was previously melted to a new charge and replaces that with some metal taken from that particular charge.

Consequently, it is not desirable to melt a number of different types of alloys on the same lining unless the question of accuracy of analysis of metal produced is relatively unimportant. If it is important that analysis be maintained accurately, a hearth upon which the alloy containing lead has been melted never should be used for melting an alloy in which lead is not desired.

Some of the lead from the previous melts is almost certain to be absorbed by the lead-free charge. This same fact holds true in the case of alloys containing aluminum and should be confined to a lining or hearth for such alloys only. Alloys containing zinc will leave some zinc behind which will be absorbed by alloys later melted.

It has been found possible to wash a furnace out relatively clean by melting down a heat or two of scrap copper, pouring it off, and using it as the copper base for the production of some alloy in which it is not important as to whether the small amounts of lead, or zinc, or aluminum as the case may be, are present. Some foundrymen have the furnaces arranged so that they can change the drums or cylinders for different types of alloys, just as other foundrymen change crucibles, maintaining each drum for a given alloy to its proper hearth or lining for the best results.

It is worthy of note in this connection that ladles into which the metal is to be poured for transference from furnace to mold, should also be maintained for specific alloys, just as the hearths are. A ladle which is used regularly for leaded alloys will be found to give off some lead to the next filling of metal, if that metal is lead free, and proper precaution is obvious.

When changing drums or cylinders, the new one of course must be preheated before the change is placed in the furnace, otherwise the charge will be subjected to an excessively long exposure to furnace gases. Never charge a cold furnace with metal; always have it preheated so that there is no slowing down of the melting process by reason of absorption of temperature by furnace walls. It is also most important to have the ladle or crucible in which the metal is poured preheated carefully so that it will not chill the metal and thus make the metal too sluggish for pouring.

Porcelain Enamel

Porcelain Enamel institute, 612 North Michigan avenue, Chicago, has issued a 162-page bulletin entitled "Proceedings of the Second Forum Porcelain Enamel Institute" which contains 20 papers and discussions presented at its second porcelain enamel forum held at Ohio State university, Columbus, O., during October, 1937. The papers are concerned with various phases of enameling such as costs, safety, welding, drawing and cleaning compounds, nickel dips, color and color matching, manufacturing, control, pig iron, foundry practice, abrasive cleaning, etc. Copies of the bulletin may be secured from the institute for $2 each.

Publish Articles

The April issue of "Sands, Clays and Minerals" published in England contains the following articles of interest to the foundry industry: "Magnesium" by L. Sanderson; "Powder Metallurgy" by W. D. Jones; "Prominent Men in Science and Industry" by W. E. S. Turner; and "Making History in Steel" by A. L. Curtis.

Engineering Experiment station, University of Illinois, Urbana, Ill., has published a 58-page bulletin on "Pressure Losses Resulting from Changes in Cross-sectional Area in Air Ducts," by Alonzo P. Kratz and Julian R. Fellows. Copies of the bulletin may be obtained for 65 cents each.

Refractory Service Increased

(*Concluded from page* 30)

of the presence of slag which coats over the surface after abrasion has taken place. For our purposes, abrasion is defined as the action of cutting away of the refractory by the friction of solid materials. Action of abrasion may be severe at high temperatures because of the partial softening of the refractory under those conditions. Abrasion usually is characterized by a rough surface, the coarser particles of which have been loosened from the ground mass, and present a ragged appearance.

Coarser particles in an abraded surface are partly torn loose from the bond or ground mass, while those in a surface left after spalling are fairly well embedded. As mentioned earlier, these ragged abraded surfaces may be covered largely with slag and the rough appearance masked. If abrasion has occurred across joints the displacement of the joints will indicate the presence of this destructive force. Abrasion of dense bodies usually is characterized by channels cut in the brick and ridges left between the channels, the ridges having sharp edges and extending in the direction of movement of the abrading material. Bung brick frequently show this channeling action.

Iron Oxide Is Active Agent

The high-iron slag encountered in the foundry industry is one of the most destructive agents at those locations in the furnaces where high temperatures exist. The large amount of iron oxide present is particularly active when the furnaces are operated under neutral or reducing conditions since the ferrous silicates formed are much more fluid and their chemical action much greater than the ferrous silicates present under oxidizing conditions. Fluorspar and similar materials added to make the slag thin so that it will separate readily from the metal and flow easily from the furnace, increase the amount of slag attack. This increase in attack not only is due to the presence of a more fluid slag but also to the active chemical attack of fluorspar and its reduction products.

Slag attack is characterized by a familiar glassy surface. A slagged brick which presents a dull or rough surface indicates that under operating conditions the slag was viscous and probably not active chemically. A smooth glassy surface indicates the slag was probably thin, and usually shows that it was active chemically. Of course, presence of particles of sand and coke may make the slagged surface look rough. Presence of the coke particles has no bearing on the condition of the slag. Presence of sand particles undissolved would show that the slag was not excessively reactive.

Severity of slag attack is increased by erosion from the movement of the slag in the furnace. Erosion brought about under such cases is defined as the cutting away of the refractory by the washing action of the slack. The fact that there is a movement of the slag indicates that the more viscous reaction product between the slag and the refractory are washed away, exposing fresh surfaces to attack. Without this movement, this reaction product acts as a protection to the refractory to a certain limited extent. Slags usually attack the bond in refractories faster than they attack the larger grains. When erosion takes place the slag movement washes away the coarser particles as soon as the bond is weakened, and thus a large part of the resistance of the refractory is destroyed.

Ridges Indicate Slag Movement

Eroded surfaces usually are characterized by appearance of grooves and ridges in the refractory remaining, ridges being well rounded in contrast to sharper ridges caused by abrasion. When the slag attack and erosion are severe these ridges are almost entirely destroyed, and grooves are wide. Direction of the grooves and ridges indicates the movement of the slag during the eroding action.

The data obtained up to this point will be sufficient for formation of a tentative statement of action going on in the brick work. In the light of this tentative statement the furnace should be watched throughout several operating cycles. The data point to the type of failure and where it may start. Observation of the furnace under operating conditions will check these data and either confirm them or show where they are in error. These observations should begin with the earliest work done in getting the furnace ready for operation. Particular attention should be paid to the location of the charge and clearance in the furnace for gas movement.

During the early stages of the firing, localized heating will be evident because these spots will show color early in the heating process. Since the spots heat up fast and at the beginning of the operation, it is reasonable to suspect that these same spots may be overheated at the end of the run. If data have shown that spalling is a factor, certain locations should be watched to note the beginning of the spalling action and the particular location in which it starts. It can be pointed out that brick spall more readily during the heating of a furnace than during the cooling under normal operation. Attention also should be paid to various evidences indicating the direction and velocity of gas movement within the furnace. The data obtained by watching the furnace in operation then should be checked against the tentative statement of the cause of the trouble.

The next step may be the most difficult one for a furnace man to carry out with an open mind. That calls for a critical examination of the construction and operation of the furnace with the view to overcoming some of the difficulty by minor changes in construction and operation. Most operators are so bound by habit that they do not seem to be able to look at the picture with the various parts in their proper relationship. Probably the most important points to look at are burner direction and throat construction. In the more up-to-date furnaces the various parts are well designed and all the refractories construction is in good condition. With continued operation of the furnaces, the usual changes taking place in the furnace change the direction of burners and alter throat construction because of spalling or slagging. Burner blocks may spall on one side giving the flame a new direction or new shape with resulting hot spots on certain locations in the furnace. In older furnaces major alterations have been made in the construction with the result that certain parts are out of proportion to the balance of the furnace. When the problem is viewed from a reasonable angle it can be seen that furnaces thus out of balance cannot be expected to operate economically.

Select the Refractory

The furnace structure and operation having been checked and reasonable alterations made to assist in the solving of the problem, the remaining work involves the selection of the refractory best suited to give economical service. The facts selected under this method with even a moderate amount of time given to details are more numerous than are usually available on any given furnace. The more carefully and painstakingly these data are obtained, the greater the possibility of solving the problem.

Selection of refractories requires an extensive knowledge not only of behavior of refractories in that particular type of service, but also certain basic principles of metallurgy and ceramics.

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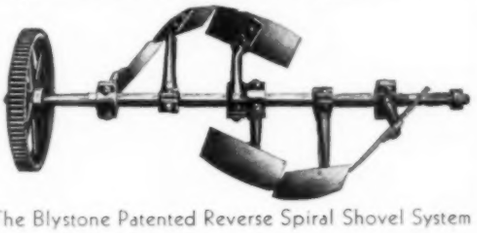

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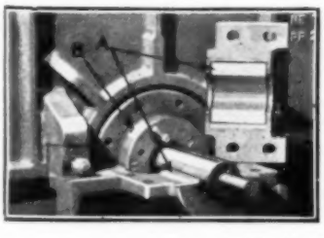

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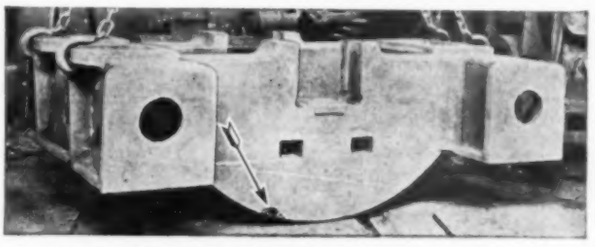

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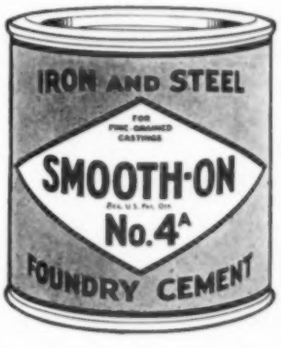

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Steels Designed For Uses

(*Continued from page* 33)

centage of carbon and requires particular heat treatment, due to the sluggishness in going through the critical range.

It has the ability to inhibit grain growth and give a high elastic ratio, and for the same strength has a much higher ductility than other types of alloy steels. Perhaps one of the most important properties of tungsten alloyed steels is their resistance to tempering and to softening. After normalizing treatment it requires a much higher drawing temperature, and due to this higher drawing temperature, internal stresses are released to a much greater extent than with other types of steel.

Tungsten alloyed steels do not require drastic quenching as they are air hardening. Four to six per cent chromium steels, alloyed with tungsten, show a marked resistance to both single blow and repeated impact, have excellent mechanical properties, and can be machined as readily as other types of alloy steels having much lower hardness.

This type of steel is characterized by the exceptional fineness of the grain, and this fine grain is undoubtedly the reason for the high elastic ratio. Temperatures of treatment that would ruin most alloy steels can be safely used in the chromium-tungsten steel. This type of steel has a high creep value and excellent scaling resistance up to temperatures of 1400 degrees Fahrenheit.

Reduce Air Hardening Properties

Titanium and columbium are used to reduce the air hardening properties of the 4-6 per cent chromium steels with tungsten or molybdenum and the 12 per cent chromium steels. They are used in the 18 per cent nickel 8 per cent chromium type of steels to reduce intergranular susceptibility in both temperature and corrosion applications.

Nitrogen is added to the high chromium steels to give better physical properties as regards to shock resistance and to decrease the grain size.

Zirconium is added to the stainless types of steels to increase the machinability and to produce non-seizing qualities. It is usually added in the form of zirconium sulphide.

Selenium is added to the austenitic 18 per cent nickel 8 per cent chromium type of steel to produce better machineability and to reduce the effect of seizing.

Table I shows chemical composition of recommended steels while Table II shows recommended heat treatment and resulting physical properties. Each of the types of steel listed in the tables has excellent properties, provided care and judgment are used in their selection for specific purposes.

Variables encountered in the manufacture of steel castings may be listed as follow:

Patterns and Core Boxes: Shrinkage allowance; use of fillets.

Molds and Cores: Types of molding sand; types and character of mixing equipment; facing materials.

Surface in Contact with Molten Metal: Green sand; dry sand; chills, nails, etc.

Supports for the Molds: Bars; gaggers, chaplets, etc.

Flow of Metal in the Mold: Design and construction of runners, gates, risers; friction and erosion; pressure exerted by the flowing metal; pressure exerted by metal

(*Concluded on page* 83)

Table I

Recommended Chemical Composition of Alloy Steel Castings

	Carbon	Manganese	Silicon	Nickel	Chromium	Molybdenum	Columbian	Titanium
Nickel Steel	.25 max.	.60-.90	.20 min.	2.0-3.0				
Nickel Steel	.20-.30	.80-1.0	.20 min.	2.0-2.25				
Chromium Nickel	.30-.40	.60-.90	.20 min.	.75-1.25	.40-.60			
Chromium Nickel	.25-.35	.60-.90	.20 min.	1.75-2.25	.60-.90			
Manganese Nickel	.20-.40	1.0-1.50	.20 min.	.75-2.00				
Manganese Vanadium (a)	.25-.35	1.0-1.50	.20 min.					
Nickel Chromium Vanadium (b)	.20-.30	.60-.90	.20 min.	1.0-1.5	.40-.60			
Chromium Vanadium (c)	.20-.30	.60-.90	.20 min.		1.0-1.5			
Nickel Vanadium (d)	.20-.20	1.0 max.	.20 min.	1.0-1.5				
Manganese	.20-.20	1.25-1.75	.20 min.					
Manganese Austenitic	.60-.80	10-15.0	1.0 max.	3.0-5.0				
Low Chromium	.25-.35	.60-.90	.20 min.		.50-.75			
Medium Chromium	.20-.30	.60-.90	.20 min.		4.0-6.0			
Stainless	.15 max.	.25-.75	1.0 max.	.80 max.	11.5-14.0		.50-.70*	
18 Chromium[1]	.30 max.	.25-.75	1.0 max.	1.0 max.	17.0-21.0		.50-.70*	.50-.80*
28 Chromium[2]	.25-.50	.25-.75	.80 max.	3.0 max.	26.0-30.0		.50-.70*	.50-.80*
Chromium Nickel Austenitic[3]	.15 max.	.40-.60	2.0 max.	8.0-10.0	17.0-20.0	1.0-3.0*	.50-.70*	.50-.80*
Chromium Nickel Austenitic[4]	.15 max.	.40-.60	2.0 max.	17.0-20.0	8.0-10.0			
Chromium Nickel Tungsten	.20-.30	.60-.90	.20 min.	1.75-2.25	.60-.90			
Chromium Tungsten[5]	.15-.25	.40-.60	.20 min.		4.50-6.50		.50-.75*	.50-.75*
Carbon Molybdenum	.15-.25	.60-.90	.20 min.			.40-.60		
Manganese Molybdenum	.20-.40	1.25-1.75	.20 min.			.40-.60		
Nickel Molybdenum	.20-.30	.40-.60	.20 min.	1.25-1.75		.20-.40		
Chromium Molybdenum	.20-.30	.40-.60	.20 min.		4.00-6.00	.60-.80		
Chromium Molybdenum	.50-.60	1.0-1.50	.20 min.		1.25-1.75	.20-.30		
Chromium Nickel Molybdenum	.25-.35	.40-.60	.20 min.	.75-1.00	.60-.90	.20-.40		

* May be specified if desired.

a, b, c and d—0.10 to 0.20% Vanadium.

[1] and [2]—0.10 to 0.20% Nitrogen* and 0.9 to 1.2% Copper*.

[3]—1-3% Tungsten; 0.20 to 0.30 % Selenium*.

[4]—0.20 to 0.30% Selenium*.

[5]—0.80 ot 1.00% Tungsten.

Phosphorus and Sulphur in all cases 0.05% maximum.

(*Continued from page* 80)

after the mold is filled; pressure of gases.

Alloy Steel: Composition; percentage variation of metals and metalloids present; nonmetallic constituents, as slag, dissolved gases.

Melting: Electric furnace, basic, acid, arc induction; open hearth, basic, acid; converter.

Temperature: Tapping; pouring.

Shrinkage and Contraction Characteristics: Actual shrinkage on cooling; volume changes due to liberation of constituents, or to allotropic changes.

Human Element: Preparation of patterns, cores, molds, etc.; assembling and closing of the molds.

Cutting Heads; Acetylene; electricity; illuminating gas.

Cleaning: Sandblast.

Grinding: Floor stand; swing; hand.

Heat Treatment: Furnace design; furnace control; fuel; electricity.

Pickling: Sulphuric acid; hydrofluoric acid.

Inspection: Inspection in the green; inspection after treatment.

The preceding outline, while admittedly incomplete, is general enough to apply to the manufacture of steel castings. The making of a casting starts with the designer, who supplies to the pattern shop a plan for a certain job. The patternmaker may err in his judgment of materials or in manipulation, and if so, the difficulties in the foundry of making good castings are increased. In making cores and molds, choice and treatment of core sands and molding sands present numerous difficulties.

Casting losses during manufacture mean money losses. They lessen profit, and mean economic waste. As castings, made of special steel, require different molding technique and are usually machined all over, they certainly are subject to some losses. However, much of the waste resulting from the loss of castings is preventable and such prevention may be accomplished by a systematic study of these losses and the use of judicious methods.

Shifting Responsibility

Losses too often are classed solely from the responsibility point, that is, molding losses, core losses, metal losses, etc. This is unfortunate and leads to a shifting of the responsibility. The positive or constructive way is to endeavor earnestly to determine the underlying causes, rather than to juggle responsibilities. It is more important to remove the cause than to find the culprit. Our one object should be to produce quality castings with no loss. If certain, well-developed schemes are followed these losses may be reduced to a minimum.

It will be possible to touch only the high spots in dealing with this vast subject of foundry technique and losses, for the origin of some of these defects is still a matter of speculation. There is often too much hysterical jumping around when losses get high, trying this and that "cure all" without first studying the problem and using a little common sense. Experience has shown that there is no substitute for constant supervision.

Publish Standards

Society of Automotive Engineers, 29 West Thirty-ninth street, New York, has published two reprints from its *S.A.E. Handbook* relating to specifications for iron and steel, and for nonferrous metals. The book on iron and steel specifications contains 100 pages giving information on S.A.E. designations for various types of steels, their composition, physical properties and methods of heat treatment. It also includes specifications for malleable iron castings and automotive gray iron castings.

The book on nonferrous metal specifications contains 82 pages giving information on compositions and physical properties of various cast and wrought nonferrous alloys, and also includes general information on protective coatings for aluminum, nickel plating, chromium plating, die materials and rare metals. Price of the iron and steel specifications is $2.50 and that of nonferrous metals is $1.50.

Western division of the American Mining congress will hold its fifth annual metal mining convention and exposition at the Ambassador hotel, Los Angeles, Oct. 24 to 27, according to Julian D. Conover, secretary of the congress.

Table II

Recommended Heat Treatmen and Physical Properties for Alloy Steel Castings

	Tensile Strength —(lbs. per sq.	Yield Point in.)—	Elongation in 2 in. (per cent)	Reduction of Area (per cent)	Brinell Hardness No.	Charpy Impact (ft. lb. V-notch)	Heat Treatment (degrees Fahr.)	
Nickel steel	80,000	50,000	22	35	175–200	15–20	1650*	1200‡
Nickel steel	85,000	55,000	22	35	175–200	15–20	1650*	1200‡
Chromium nickel	100,000	65,000	18	30	200–225	8–10	1650*	1150‡
Chromium nickel	100,000	65,000	18	30	200–225	8–10	1650*	1150‡
Manganese nickel	100,000	65,000	18	30	200–225	8–10	...	...
Manganese vanadium	90,000	60,000	18	30	200–225	10–12	1650*	1200‡
Nickel chromium vanadium	90,000	60,000	20	30	200–225	15–25	1650*	1250‡
Chromium vanadium	90,000	60,000	20	30	200–225	10–15	1650*	1150‡
Nickel vanadium	90,000	60,000	20	30	200–225	15–25	1650*	1250‡
Manganese	90,000	60,000	18	30	200–225	8–10	1650*	1200‡
Manganese austenitic	No physicals required				...	...	2000	....§
Low chromium	90,000	55,000	18	30	200–225	10–12	1650*	1250‡
Medium chromium	100,000	65,000	18	30	200–225	10–12	1650*	1150‡
Stainless	80,000	50,000	20	30	200–225	10–15	1650*	1200‡
18 Chromium	90,000	55,000	5	5	200–225	5	1650†	...
28 Chromium	55,000	40,000			150–170	5	1650†	1100§
Chromium nickel austenitic	70,000	30,000	35	40	180–200	80–120	1900–2100	....§
Chromium nickel austenitic	65,000	30,000	30	35	160–180	80–120	1900–2100	....§
Chromium nickel tungsten	100,000	65,000	18	30	200–225	8–12	1650*	1100‡
Chromium tungsten	125,000	95,000	18	45	200–225	15–20	1750*	1250‡
Carbon molybdenum	80,000	50,000	22	40	150–170	20–25	1800* 1600*	1275‡
Manganese molybdenum	90,000	60,000	18	30	175–200	12–15	1700*	1250‡
Nickel molybdenum	80,000	50,000	22	40	175–200	15–25	...	...
Chromium molybdenum	110,000	85,000	18	45	200–225	10–15	1650*	1200‡
Chromium molybdenum	140,000	120,000	7	10	325–350	4– 6	1800* 1575*	1000‡
Chromium nickel molybdenum	90,000	60,000	16	30	200–225	12–20	1650*	1250‡

* Air cooled. † Furnace cooled. ‡ Draw. § Water quenched.

OBITUARY

JOHN GAY, 57, vice president and general superintendent, Schwartz Foundry Co., Detroit, died on June 3. Mr. Gay, who went to Detroit more than 30 years ago, was born in St. Thomas, Ont.

* * *

Edwin E. Russell, vice president, J. I. Case Co., Racine, Wis., died June 6.

* * *

William F. Kingston, 55, former vice president of the American Car & Foundry Co., died in St. Louis on June 6.

* * *

A. J. Oaks, 70, senior partner and general manager of the South Fork Foundry & Machine Co., South Fork, Pa., died June 4 at his home in that city.

* * *

Herbert M. Ramp, 69, formerly foundry superintendent, La Porte, Ind. works of Allis-Chalmers Mfg. Co., died at his home in La Porte, April 23.

* * *

Samuel S. Fair, 64, prominent Bay City, Mich., business man and president of Fair & Son, Inc., operating a steel casting foundry in Saginaw, died May 31, in Ann Arbor, Mich.

* * *

Arthur H. Beeman, 62, district sales representative in Michigan and Ontario for the Ironton Firebrick Co., Ironton, O., died at his home in Windsor, Ont., on May 21.

* * *

Frank Foster Dodge, 53, chairman and former president of the Atwood Machine Co., Stonington, Conn., died recently in Westerly, R. I. Mr. Dodge was graduated from Harvard university in 1908.

* * *

Benjamin B. Shannon, 54, foundry superintendent, Gale Mfg. Co., Albion, Mich., died recently at his home. Mr. Shannon was born March 4, 1884, in Licking county, Ohio, and went to Albion in 1914 when he entered the employ of the Gale company as a molder. Six years later he became assistant foreman in the foundry and in 1926 was made foundry superintendent.

* * *

Ernest Burkhardt, 79, Denver foundry executive for more than half a century, died at his home there on May 29. President of Burkhardt & Sons Steel & Iron Co., he was born in Germany and came to the United States 60 years ago, spending 4 years in Detroit. He then went to Denver and in 1881 established the structural steel and ornamental iron foundry that bears his name.

* * *

Arthur P. Van Schaick, 56, vice president and director, American Chain & Cable Co. Inc., died June 7. He joined the American Chain company at Bridgeport, Conn., as manager of sales in 1919. Several years later he was elected a director and 3 years ago was made vice president in charge of sales of all divisions. He also was a director of the Chain institute, and former president, American Hardware Manufacturers' association.

* * *

Theodore Ahrens, 79, chairman of the board, Standard Sanitary Mfg. Co., Pittsburgh, and a founder of the American Radiator Co., died in Louisville, Ky., on June 12. Mr. Ahrens was the founder and first president of the Standard Sanitary Mfg. company which he headed for 30 years. In 1929 he helped form the American Radiator & Standard Sanitary Mfg. Corp. of which he was president until 1936 when he resigned.

* * *

Walter O. Parham, vice president, Keokuk Steel Casting Co., Keokuk, Iowa, died on June 11, in that city. Mr. Parham entered the steel foundry business in 1910 and had been active ever since. Previous with his connection with the Keokuk company he had been associated with the American Steel Foundries, Allied Steel Casting Co., Hubbard Steel Foundry Co., Northwestern Steel & Iron Co., and the Foote Bros. Gear & Machine Works.

* * *

M. Z. Fox, 67, Chicago resident manager the Hill & Griffith Co., Cincinnati, for the past 33 years, died in Chicago May 28. Mr. Fox was born in Stockbridge, Mich., in 1871 and was educated there in the public schools. In later years he enjoyed a wide acquaintance among foundrymen of the Middle West, Ohio, Michigan and Indiana, through his connection first with Frederic B. Stevens Inc., Detroit, and the Detroit Foundry Supply Co., Detroit and afterward for the long period of 33 years with the Hill & Griffith Co., Cincinnati.

* * *

Byron H. Edwards, president, Ideal Furnace Co., Detroit, died in Detroit, May 30. Born in Toledo, O., Dec. 6, 1867, Mr. Edwards went to Detroit from Ypsilanti, Mich., in 1894 to engage in the hardware business, later becoming associated with the Peerless Heater Co. In 1896 he founded the American Sadiron Co. and 1898 he entered the warm air register manufacturing field with the Detroit Register Co. Later these two firms were merged into the Detroit Furnace & Heater Co. In 1903 Mr. Edwards founded the Ideal Furnace Co. which absorbed the Sadiron company, the Register company and the American Heater & Foundry Co., of Chicago.

Adventures of Bill

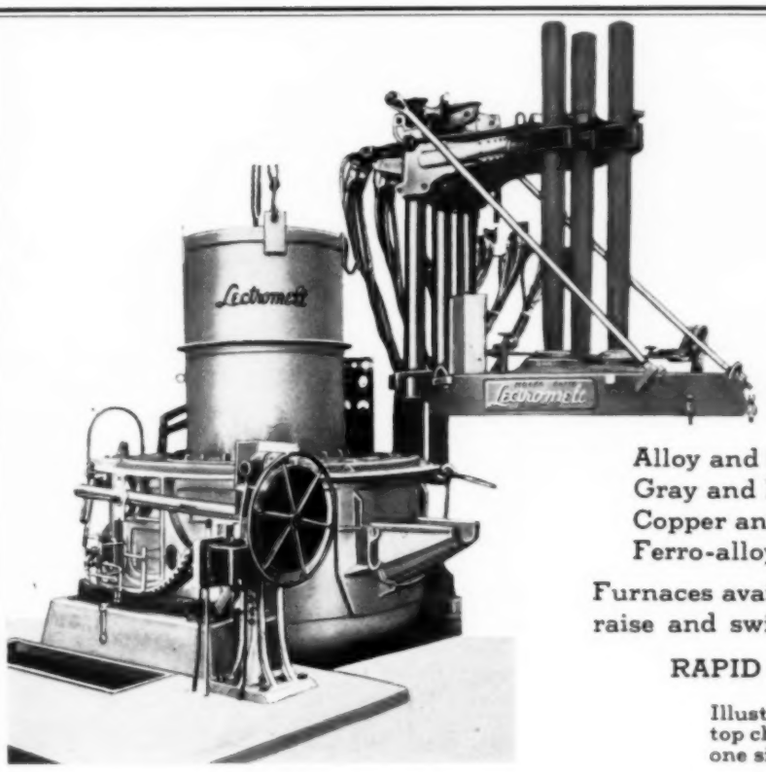
(*Concluded from page* 52)

has blunted my sense of smell to a considerable extent, but I still prefer the smell of the foundry to the type of perfume flaunted by certain women whose sense of smell apparently is on a par with their color blindness in facial makeup. I am not prepared to claim that a foundry smells as fresh and sweet as a field of new mown hay, or a spray of roses in the moonlight, but at least the smell is not offensive. Certainly it is a noble factor in reviving memories of people, events and places that over a period of years like the flowers of the forest had faded away. The other day I tried vainly to recall the name of a lad who served his time with me. Later on the way home we passed a bakery and got a whiff or two of the atmosphere. The lad's name flashed into my mind, also many other items connected with the same period as sharp and clear as if I was standing by the core oven door in the old shop."

"Those were the days when flour, molasses, claywash and stale beer were the standard binders for core sand and blacking. Almost every shop had a local tradition about the time a barrel of good beer was shipped into the shop by mistake and how the boys held loud wassail while it lasted. Did I ever tell you about the time Paddy McGlynn filled his dinner bucket with some prime molasses? With true fatherly solicitude he intended to take it home and regale the young McGlynns with a mess of molasses taffy. The boss of the core room was deeply grieved over this petty pilfering. While Paddy was busy elsewhere this guardian of the master's property spilled a large handful of sharp sand into the molasses and stirred it up thoroughly. Sez he to himself, sez he, 'Here's something for the young McGlynns to sharpen their teeth on.'"

"Did they eat the stuff?"

"Well," said Bill, "yes and no. After the first crunchy bite the children and their mother claimed the old bird was trying to poison them. To prove that they were mistaken in this filial and charitable assumption he swallowed a slab and declared that outside of a slight grittiness, it was entirely palatable. Paddy had no teeth to serve as a sand trap."



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Alloy and Carbon steels
Gray and Malleable irons
Copper and Nickel and Alloys
Ferro-alloys, Carbide, and Special products

Furnaces available in top-charge type with quick raise and swing roof—also in door-charge types.

RAPID - ECONOMICAL - RUGGED

Illustration shows new LECTROMELT top charge furnace with roof rotated to one side and charging bucket in place.

PITTSBURGH LECTROMELT FURNACE CORP.
P. O. BOX 1257 PITTSBURGH, PA.

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We offer
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176 Johnson St. Brooklyn, N. Y.

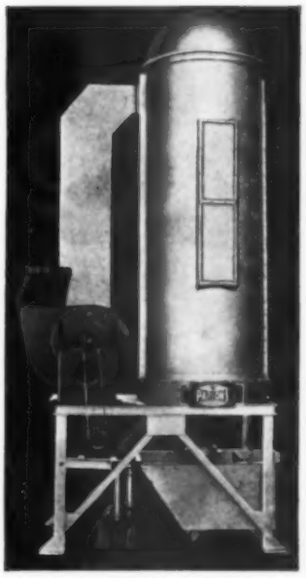
NEW ROTO-WASH DUST COLLECTOR

If you missed seeing it in operation at the show, let us send a descriptive bulletin now.

For ventilating shakeouts and other equipment in your cleaning room—it can't be beat.

The Parsons Roto-Wash Dust Collector uses three distinct methods of mixing the dust-laden air with water — namely, a wet louvred cyclone, a cascading baffled collector and a rotor vane impinging unit.

Parsons now builds two outstanding types of dust arrestors—the time-proven Oval Bag cloth type and this amazingly efficient Roto-Wash Dust Collector.



"Let Parsons Clear the Air for You"

PARSONS ENGINEERING CORP.
3589 East 82nd Street Cleveland, Ohio

Malleable Founders Hold Meeting

Reports of committee activities and a discussion of problems of the industry featured the annual meeting of the Malleable Founders' society held June 16 and 17, at the Greenbriar hotel, White Sulphur Springs, W. Va. At the close of the meeting, Frank O. Parker, general sales manager, Acme Steel & Malleable Iron Works, Buffalo, was elected president of the society, John A. Wagner, president, Wagner Malleable Iron Co., Decatur, Ill., was named vice president and Robert E. Belt was re-elected secretary-treasurer. All 12 directors of the society were re-elected.

In opening the meeting, Arthur F. Jackson, president, Michigan Malleable Iron Co., Detroit, and retiring president of the society, stressed the value to the industry of having the technical work of the group handled in a co-operative way. Mr. Jackson also pointed to the progress which has been made by the technical committee. Robert E. Belt, secretary-treausrer, presented a review of the various activities of the society during the past year.

Enrique Touceda, consulting engineer of the society, in a paper "Gating and Feeding" discussed the subject matter which will be taken up at the next round of shop practice meetings starting about July 15. Professor Touceda also discussed the use of chills or alloying additions to increase the mineralogical hardness of white iron.

James H. Lansing, shop practice engineer of the society, presented an exceptionally complete report on "Annealing Furnaces; Fuels, Cycles; Costs." Mr. Lansing presented operating data on every type of annealing equipment now used in the malleable industry and discussed every annealing cycle now in commercial use. The report started with the cost of installing the various types of equipment and ended with a discussion of operating costs and results obtained.

E. E. Griest, vice president, Fort Pitt Malleable Iron Co., Pittsburgh, and chairman of the society committee on new uses, reviewed the work of the committee during the past year. The new uses committee has recommended that the distribution of news articles on uses of malleable iron be continued and that the work be enlarged through the publication of a monthly organ featuring new malleable iron uses and pertinent engineering data. Decision on the committee's recommendations will be made by letter.

On Friday morning, James H. Lansing presented lantern slide illustrations and a summary of the discussion of the paper "Malleables for Engineering Uses" presented at the recent Rochester meeting of the American Society of Mechanical Engineers by Mr. Touceda and Mr. Lansing. It was stated that during the past year, Mr. Lansing has taken part in eight meetings of a similar character in various parts of the country.

John A. Wagner presented an interesting discussion of methods used by his company in controlling production costs with volume changes. Anthony Haswell, vice president, Dayton Malleable Iron Co., Dayton, O., presented a summary recently made of existing wage differentials in the industry. A committee of the society expects to make recommendations based on the data collected, in an effort to bring about greater equity in earnings of employes as between different classes.

Homer M. Wright, metallurgist, Michigan Malleable Iron Co., Detroit, presented a paper, "Surveys of Pearlitic Malleables Covering Properties, Manufacture and Fields." Mr. Wright is head of a committee known as the technical council, composed of eight technicians of the industry, which recently has made an extensive survey dealing with production, characteristics and uses of each class.

French Association Elects Officers

The officers of the Association Technique de Fonderie, of Paris, for the year 1938-39 have been elected as follows: Henri Sandre, president of Societe Metallurgique du Perigord; senior vice president: Henry Strube, foundry owner, president of the Syndicate of Nonferrous Founders of France.

French vice presidents: Pierre Chevenard, chief of the research department of Societe Commentry-Fourchambault et Decazeville, professor at the Ecole Superieure de Fonderie; Jean Derdinger, foundry owner, honorary president of the Syndicate of Nonferrous Founders of France, professor at the Ecole Superieure de Fonderie; Charles Koehler, president of Societe Auxiliaire de l'Enseignement Technique, general secretary of Syndicat General des Fondeurs de France, president of Societe des Fonderies de Saint-Ouen; Jean Lobstein, president of the Syndicate of Iron Founders of the Paris district, managing director of Usines Lobstein; Roger R. Meyer, co-partner of Societe de Produits Metallurgiques; Leon Montupet, managing director of Fonderies Montupet; Augustin Rousseau, president of Association Amicale et Mutuelle de Fonderie, managing director of Societe d'Editions Techniques, manager of *La Revue de Fonderie Moderne*.

Foreign vice presidents: For Luxemburg: Leon Brasseur, engineer; for Spain: J. M. Espana, honorary commercial attache for Spain in Paris; for Belgium, Joseph Leonard, president of Association Technique de Fonderie of Belgium, general manager of Societe Angleur-Athus; for Italy: Guido Vanzetti, managing director, S. A. Fonderia Milanese di Acciaio Vanzetti.

General secretary: Charles Dennery, foundry engineer. Treasurer: Daniel Waeles, bronze founder, vice president of the Syndicate of Nonferrous Founders of France.

Publish Handbooks

Two compact and concise handbooks for nonferrous foundrymen and for electroplaters recently have been published by *Metal Industry*, 116 John street, New York. The first handbook is entitled, "1938 Casting Manual-Nonferrous Metals," and was prepared by Sam Tour, Lucius Pitkin Inc., New York. It contains 52 pages and relates to classification of copper-base alloys, raw materials, melting, refractories, pouring, gating, molding, defective castings, and properties of copper-base alloys. The second handbook, "1938 Plater's Guidebook," was prepared by T. H. Chamberlain and G. B. Hogaboom. It describes such phases as measuring thickness of electrodeposited coatings, specifications for electroplated steel, voltage control generators, rectifiers, conductor sizes, tanks, drying, etching, stripping, electroplating solutions, recovery of gold and silver, metal coloring, analyzing solutions, and polishing, buffing and coloring.

Steel Statistics

The twenty-sixth annual statistical report of the American Iron and Steel institute, covering the year 1937, and presenting statistics of the iron and steel and some related industries of the United States and Canada, recently has been published. Statistics are given on pig iron and ferroalloys, scrap consumed in blast furnaces and steel making furnaces, steel capacities, production of rolled products, exports of iron and steel, imports of iron and steel, ore statistics, coal and coke statistics, market prices, Canadian statistics and other foreign statistics.

Washington Nickel Mining & Alloys Inc., American Bank building, Seattle, is building a plant to smelt an alloy iron ore and produce a pig iron to be marketed under the name of Mincerite.

NEW EQUIPMENT and SUPPLIES

Grinding Wheels

Abrasives Co. division, Simonds Saw & Steel Co., Philadelphia, re-recently has improved its large hole, high speed, resinoid bonded, grinding wheels for rough snagging operations. The improvement consists of two circular steel flanges permanently imbedded and bonded into the sides of the wheels immediately adjacent to and surrounding the center hole and lining a portion of it. Each flange is said to be an independent unit in alignment with the other, and to consist of a flat circular steel surface disposed flush in the side of the grinding wheel surrounding the center hole; an edge flange lining a portion of the center holes, and a portion extending into the grinding wheel itself parallel to its axis of rotation.

Steel flanges are permanently imbedded in resinoid bonded snagging wheels

Advantages claimed for the flanges include reduced wear on mounting flanges and mount center; center hole dimension is held to accurate tolerance providing a better fit, and wheel is held between solid plane bearing surfaces eliminating use of gaskets or blotters. Flanges protect center hole and prevent chipping sides or edges of hole when mounting or handling wheel. Wheels now available with flanges are 24 inches in diameter, 3 incnes thick with 12-inch hole.

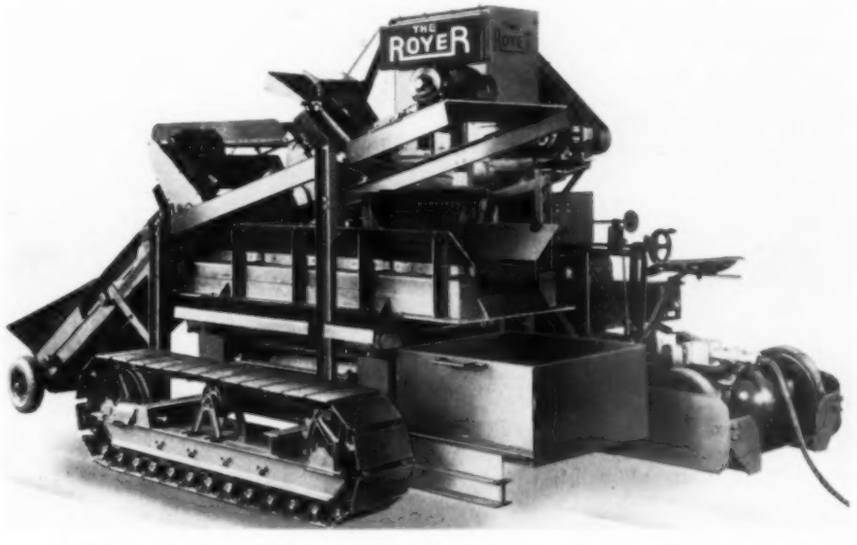
Portable Unit

Features of the portable shakeout and sand conditioning unit, shown in the accompanying illustration, and made by the Royer Foundry & Machine Co., Kingston, Pa., include: Shakes out the casting; removes the scrap; delivers casting and scrap directly into a tote box; tempers the sand; mixes, aerates and delivers the sand alongside the molding machine.

The device operates on a crawler tractor which brings the machine to the molds instead of the usual practice of bringing the molds to the snakeout A belt conveyor in front of the machine carries the molds up to the shakeout position. Castings, scrap, chills, nails, etc., are carried to the back where they fall into a tote box which is removed and replaced periodically. Sand falls through to a belt where it is tempered and delivered to a bucket elevator which discharges on to a sand separator and blender which in turn throws it in a pile close to the molding machine ready for use.

Electrode

Harnischfeger Corp., 4400 West National avenue, Milwaukee, has introduced a new electrode designed for welding 4-6 per cent chrome steel. The electrode deposits weld metal which has the same properties as the parent metal. The electrode contains from 4 to 6 per cent chromium and 0.50 per cent molybdenum.



Portable combination unit shakes out the castings and reconditions the sand

FOUNDRY ACTIVITIES

JOHNSON BRONZE CO., New Castle, Pa., maker of bronze bushings, bearings, and castings, contemplates erection of a one-story addition, 75 x 145 feet to cost about $50,000 with machinery.

* * *

Bostick Foundry, Lapeer, Mich., recently sustained damage by a fire.

* * *

Educational Bronze Memorials, 424 West Forty-sixth street, New York, is opening a bronze foundry.

* * *

Wabi Iron Works, Ltd., New Liskeard, Ont., plans to build an iron foundry at Noranda, Que.

* * *

National Art Bronze Foundry Work Co. Inc., Pope avenue, St. Louis, recently was damaged by fire.

* * *

Star Foundry, 47 Horton street, Seattle, recently was damaged by fire. Loss has not been determined.

* * *

American Seating Co., Grand Rapids, Mich., has plans for erection of a one-story addition to cost about $45,000 with equipment.

* * *

One building of the Colonial Foundry Co., Louisville, O. was destroyed by fire and another damaged. Loss was estimated at $10,000.

* * *

Miller's S. & S. Foundry, 3307 East Pico boulevard, Los Angeles, is building a foundry addition 30 x 31 feet at a cost of $1000.

* * *

Roberts Brass Mfg. Co., 5435 West Fort street, Detroit, plans extensions and improvements costing close to $30,000 with equipment.

* * *

Fisher Brass Co., Marysville, O., manufacturer of brass and bronze products, has let general contract for one-story addition, costing approximately $40,000 with equipment.

* * *

Foran Foundry, Flemington, Pa., which recently sustained damage by fire, plans to start reconstruction work immediately. (Noted June issue.)

* * *

John Deere Tractor Co., Waterloo, Iowa, L. A. Rowland, general manager, has awarded contract to E. W. Sproul Construction Co., Chicago, for erection of a three-story factory addition, 100 x 140 feet.

* * *

Rock Island Mfg. Co., Rock Island, Ill., a subsidiary of the Birtman Electric Co., Chicago, has been liquidated, and the Birtman Electric Co. has taken over the assets.

* * *

Bay State Iron Foundry, South Boston, has taken over the business of the J. E. Plimpton & Co. Foundry, Norwood, Mass., and is operating both divisions.

* * *

Foundry of the Strickland Machine Shop, Tuscaloosa, Ala., recently was damaged by fire. Loss was estimated at several thousand dollars.

* * *

J. P. Kelly, J. P. Kelly Brass Foundry, Philadelphia, recently has acquired the foundry building formerly occupied by the Bureau Bros. Inc. at Twenty-third and Westmoreland streets.

* * *

Beaver Foundry & Furnace Works Ltd., Tillsonburg, Ont., R. C. Crandell, general manager, plans a plant addition. The site has been purchased and the cost is estimated at $40,000.

* * *

Tonawanda Foundry & Machine Corp., Tonawanda, N. Y., C. E. Boyd, president, suffered damage to patterns of $10,000 in a recent fire. Considerable damage also was done to office quarters and office equipment.

* * *

C. & G. Foundry & Pattern Works, Indianapolis, has purchased the Enterprise Iron Works, Indianapolis, maker of ornamental iron works, fences and railings. No change will be made in operation of either firm and they will be continued as separate organizations.

* * *

Los Angeles Foundry Co., 2444 South Alameda street, Los Angeles, recently acquired all foundry supplies and nonmetallic minerals in the plant of the Chamberlain Co. Inc., 2550 E. Olympic boulevard, Los Angeles.

* * *

Link-Belt Co., Chicago, has awarded a general contract to Carl M. Geupel Construction Co., Hume-Mansur building, Indianapolis, for a one-story addition to its branch plant in that city. The contract also calls for a one-story boiler house. Estimated cost, $250,000 with equipment.

* * *

Pomona Pump Co., Pomona, Calif., has enlarged its plant until it now covers three city blocks and provides a railroad frontage of 600 feet. The plant's production facilities have been augmented greatly by completion of a new foundry building. Work is scheduled to begin soon on a new office structure.

* * *

Gallipolis Stove & Foundry Co., Spruce and Second streets, Gallipolis, O., which recently was organized with B. C. Zuhars president and general manager, is installing new equipment. Through an error, the address of that company was given as Athens, O., in the June issue.

* * *

Orders for foundry equipment made a small gain in May, the net order index being 90.6 compared with 79.3 in April and 237.6 in May, 1937, according to the Foundry Equipment Manufacturers' association. Shipments, on the other hand, dropped from 93.4 in April to 91.3 in May, compared with 226.2 in May last year. The unfilled order index for May was 157.5, compared with 158.2 in April and 376.8 in May, 1937. Three months average of gross orders was 94.9 in both April and May, compared with 248.1 for May, 1937. Indexes are based on 1922-24 as 100 per cent.

RAW MATERIAL PRICES

June 23, 1938

Iron	
No. 2 foundry, Valley	$24.00
No. 2 Southern Birmingham	20.00
No. 2 foundry, Chicago	24.00
No. 2 foundry, Buffalo	24.00
Basic, Buffalo	23.00
Basic, Valley	23.50
Malleable, Chicago	24.00
Malleable, Buffalo	24.50
Charcoal iron, furnace	27.00
Coke	
Connellsville beehive premium	$ 5.75 to $ 6.25
Wise county beehive coke	5.50 to 6.50
Detroit by-product delivered	11.10
Scrap	
Heavy melting steel, Valley	$12.00 to $12.50
Heavy melting steel, Pitts. (dlv.)	11.50 to 12.00
Heavy melting steel, Chicago	9.50 to 10.00
Stove plate, Buffalo	10.50 to 11.00
Stove plate, Chicago	6.50 to 7.00
No. 1 cast, New York	9.50 to 10.00
No. 1 cast, mchy., Chicago	10.00 to 10.50
No. 1 cast, Pittsburgh	12.50 to 13.00
No. 1 cast, Philadelphia	14.50 to 15.00
No. 1 cast, Birmingham	14.00 to 14.50
Car wheels, iron, Pittsburgh	12.00 to 12.50
Car wheels, iron, Chicago	11.50 to 12.00
Railroad malleable, Chicago	11.00 to 11.50
Malleable, Buffalo	12.00 to 12.50
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	8.52½
Straits tin	42.65
Aluminum, 99 per cent	20.00
Aluminum, No. 12 (Secondary, standard)	14.00 to 14.50
Lead, New York	4.35
Antimony, New York	11.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.25 to 4.40

Another New One ! !

U.S. MODEL 500 GRINDER

A marked advance in efficient grinding precision and lowered operating costs.

Model 500 features

Polyphase totally enclosed motor;
No dust, dirt or abrasives can reach bearings, motor windings or rotor;
Anti-friction bearings, permanently lubricated, totally enclosed;
Wheel guards adjustable to wheel wear;
Push button starter with overload protection.

A QUALITY PRODUCT
AT AN AMAZINGLY LOW PRICE

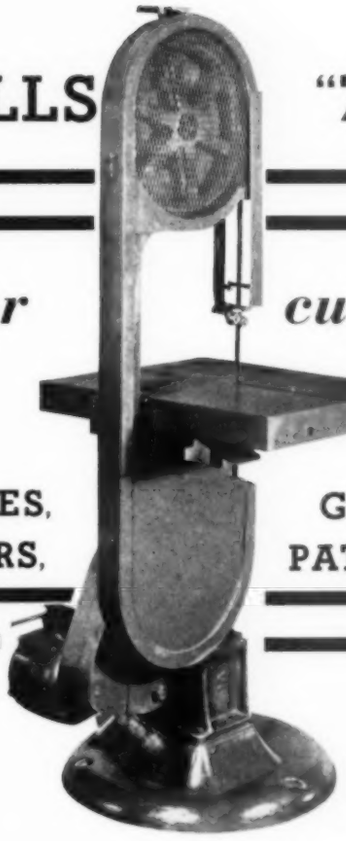
Write us for full details

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO, U.S.A.

WELLS "7A"

For cutting

SPRUES, RISERS, GATES, PATTERNS



The *"All-Purpose"* FOUNDRY SAW

● WELLS 7-A Band Saw has established a reputation for flexible, low cost cutting operation in the foundry. Designed to handle castings of all metals and shapes, a faster, closer to the casting surface cut is assured when trimming sprues, risers and gates. For pattern shop application, a high speed blade range permits easy conversion into a highly productive wood cutting unit.

Here are a few details of WELLS 7-A Band Saws that have lowered production costs in many foundries. Saw table is adjustable to any desired angle necessary for proper working plane. A blade speed ranging from 60 ft. to 1400 ft. per minute permits correct setting for every material requirement. It is rigidly constructed to withstand abuse and assure years of trouble-free service.

Let Wells demonstrate the 7-A saw to you without obligation and learn first hand its many time and labor saving usages.

Write for complete information.

• *Saw it the WELLS Way* •

WELLS MFG. CORP. Three Rivers, Michigan

The Modern Electric Hoist

SHEPARD NILES CRANE & HOIST CORP.
360 SCHUYLER AVENUE, MONTOUR FALLS, N. Y.
A COMPLETE LINE OF CRANES AND HOISTS

NEW TRADE PUBLICATIONS

Copies of any of the literature listed below may be obtained by writing directly to the companies involved, or by addressing THE FOUNDRY, in care of Readers' Service Department, 1213 West Third Street, Cleveland

TESTING EQUIPMENT — "Modern Analysis" is the title of a new 24-page booklet published by Harry W. Dietert Co., 9330 Roselawn avenue, Detroit. This booklet describes and illustrates determinators for sulphur and carbon as well as spectographic and microscopic equipment, and sand, coke and mold testing equipment.

PIG IRON—Wisconsin Steel Co., Harvester building, Chicago, recently has published "Wisconsin Pig Iron" which describes that company's production of pig iron. A new small size pig is described and analyses are given of the old and new size pigs of the foundry and malleable iron of the company.

ARC WELDER—A folder issued by Hobart Bros., Troy, O., entitled "1000 combinations" describes their new multi-range arc welders.

DUST COLLECTING—Kirk & Blum Mfg. Co., Cincinnati, just has published a 24-page booklet describing and illustrating dust collecting systems in metal industries. Numerous typical installations in the foundry industry are shown.

FACINGS—Smith Facing & Supply Co., 1857 Carter road, Cleveland, has prepared a series of calendar blotters featuring the sayings of Bill Gagger and outlining the various products supplied by the company.

CONVEYORS — Overhead materials handling systems and the need to eliminate rehandling are described in a folder recently issued by Cleveland Crane & Engineering Co., Wickliffe, O.

DUST CONTROL—Pangborn Corp., Hagerstown, Md., recently has published a folder describing the effects of dust in the plant and the benefits from the installation of dust control and blast cleaning equipment.

DUST COLLECTOR—Bulletin No. 274 giving engineering data and performance tables of a dual function exhauster and dust collector has been published by the American Air Filter Co. Inc., 116 Central avenue Louisville, Ky. The 16-page bulletin gives tables, diagrams, and illustrations of the company's roto-clone dynamic precipitators and precleaners.

CONVEYORS — "Equipping Industry for Continuous Production" is the title of a 32-page booklet published by Mathews Conveyer Co., 196 Tenth st., Ellwood City, Pa. This booklet describes and illustrates 17 types of conveyors which include roller, belt, pallet, wheel, chain, apron, trolley, pusher-bar, chute, hoist, spiral and portable conveyors. Ball transfers are described as used for moving objects with smooth, hard riding surfaces. Dimensions and diagrams are given in the book.

CUPRO-NICKEL CASTINGS — International Nickel Co., New York, has published section 2, bulletin 404, called, "Production of Pressure Tight Castings in 30% Cupro-Nickel." This bulletin is a reprint of a paper given by T. E. Kihlgren, metallurgist, International Nickel Co., before the Nonferrous Division meeting at the forty-first annual convention of the American Foundrymen's association, Milwaukee, 1937. The bulletin also includes the discussion which followed the presentation of the paper at the convention. Many illustrations and diagrams accompany the material as presented.

LADLES — Whiting Corp., Harvey, Ill., has published a well illustrated booklet showing its line of ladles for foundry service. Specifications and other information are given on helical worm geared crane ladles, insulated covered ladles, cylindrical mixing ladles, reservoir ladles, teapot spout ladles, bottom tap ladles, truck ladles, shank and trolley ladles and hand ladles.

Faked Foundry Facts

"Travelling Crane"

FURNACES — Campbell-Hausfeld Co., 300 Moore street, Harrison, O., has published a folder illustrating and describing its gear tilting crucible furnace, lever tilting crucible furnace, stationary crucible furnace, stationary furnace for aluminum and other soft metals, its tilting pot furnace and laboratory furnace.

OVENS — A folder discussing the economy of its design of ovens for baking cores and molds has been published by the Willsea Works, 1042 University avenue, Rochester, N. Y. It is pointed out that the controller can be set to hold a temperature within a variation of 20 degrees.

FOUNDRY EQUIPMENT — Jeffrey Mfg. Co., Columbus, O., has published a catalog No. 690 in which its complete line of foundry equipment is illustrated and described. Materials discussed in the publication include sand reclaiming and conditioning systems, continuous pouring systems, mold conveyers, trolley conveyers, bucket elevators, apron conveyers, flask fillers, sand mixers, sand aerators, portable sand conditioners, crushing and pulverizing equipment, etc.

BUILT-UP ROOFS — Johns-Manville Corp., 22 East Fortieth street, New York, has issued a new edition of its 36-page book on bonded built-up roofs. The publication is devoted to specifications and illustrations of applications for various types of roofs.

CUPOLA CHARGER — A skip hoist type of cupola charger is described and illustrated in a recent publication of the Modern Equipment Co., Port Washington, Wis. The text covers advantages and information required for installing the charging equipment. Information also is given on the other products of the company which may be used in the foundry.

DEOXIDIZER — Carborundum Co., Refractory division, Perth Amboy, N. J., has published a folder on ferrocarbo, a material composed chiefly of silicon carbide which in cupola operation, it is claimed makes possible the use of harder charges with higher percentages of steel and scrap. Information on application of both the briquetted and the granular forms is given.

FIRESTONE — Cleveland Quarries Co., Builders Exchange Bldg., Cleveland, have published a 24-page booklet on Firestone, a siliceous rock quarried at Amherst, O. The refractory is employed in soaking pits, bessemer converters, blast furnace ladles, mixers, cupolas, air furnaces, etc. Technical information relative to the features of Firestone are presented.

SAND CONDITIONING — American Foundry Equipment Co., 555 South Byrkit street, Mishawaka, has published two catalogs dealing with sand conditioning by the Sandcutter method. The catalogs are well illustrated and show mechanical features and construction details together with views of applications in various types of foundries.

SAND HANDLING — Link-Belt Co., Chicago, recently has published a booklet entitled "Today's Sand Preparation and Handling Methods". The publication features reproductions of advertisements which have been directed to the foundry industry in the belief that study of this material will provide reductions in cost and the production of better castings.

SAND MIXERS — National Engineering Co., 549 West Washington boulevard, Chicago, has published a twenty-fifth anniversary catalog which deals with the various types of Simpson mixers utilized in the preparation of molding and core sand. The publication is well illustrated with photographs and drawings of the equipment as well as illustrations of numerous installations.

FLASKS—Truscon Steel Co., foundry flask division, 6100 Truscon avenue, Cleveland, has published a catalog on its line of foundry flasks. Information is given on manufacturing facilities, sectional sizes, types of flasks available, pin lugs, trunnions, and applications of the flasks. Data also are given on accessories, material handling equipment such as skid platforms, steel boxes, etc.

CRUCIBLES — Crucible Manufacturers association, 90 West street, New York, recently has published a booklet entitled "How To Cut Crucible Costs." Information includes the storing, handling and use of crucibles; charging, furnace tending, fuel, pouring; tongs and shanks; crucibles for various fuels, furnaces and alloys; and data on melting points, composition of steam and red brass alloys, aluminum sand casting alloys, and crucible sizes.